ICASE
International Conference on AEROSPACE SCIENCE & ENGINEERING

SEVENTH INTERNATIONAL CONFERENCE ON

AEROSPACE SCIENCE & ENGINEERING

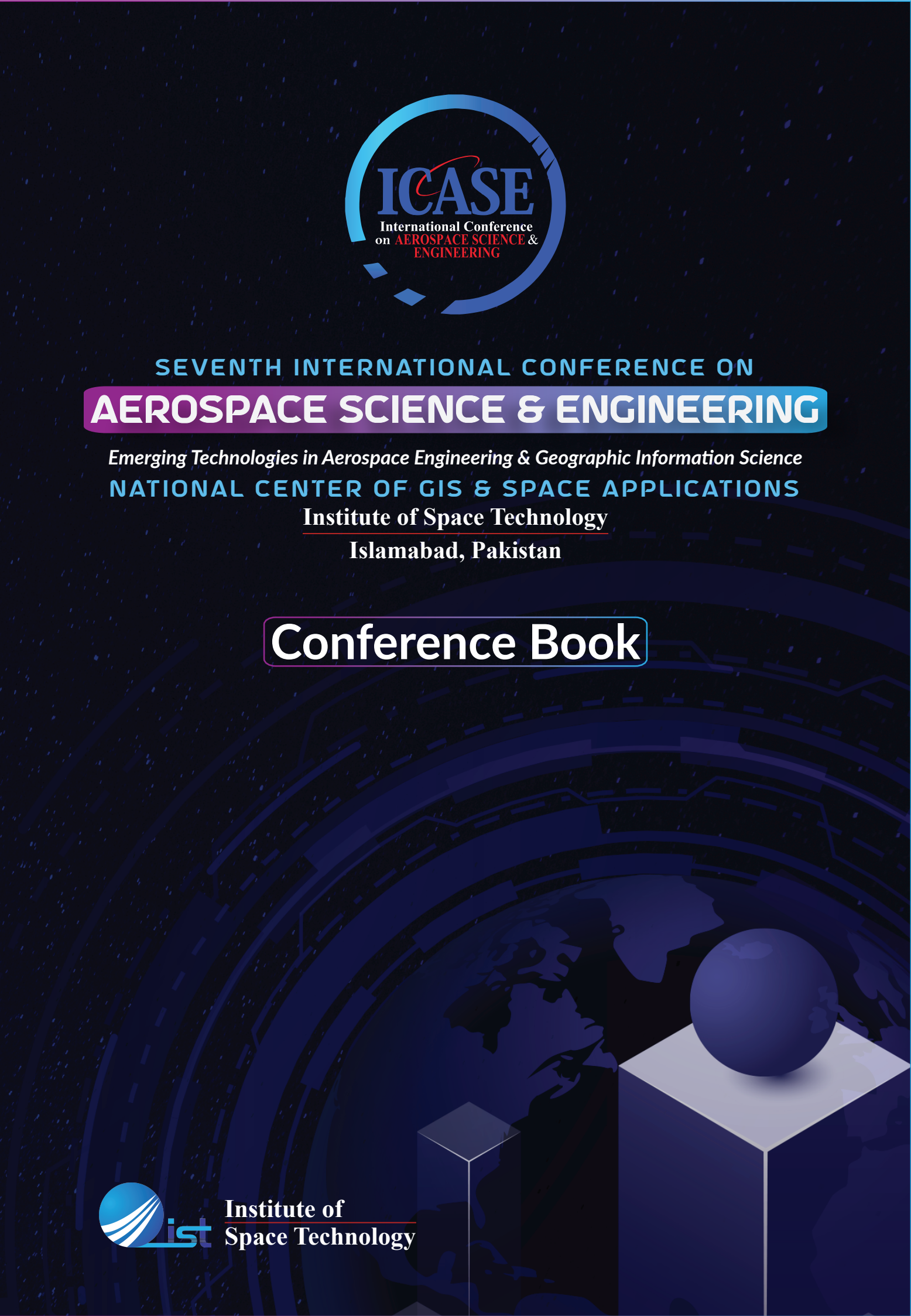
Emerging Technologies in Aerospace Engineering & Geographic Information Science

NATIONAL CENTER OF GIS & SPACE APPLICATIONS

Institute of Space Technology

Islamabad, Pakistan

Conference Book



Institute of Space Technology

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

NCGSA
NATIONAL CENTER OF GIS & SPACE APPLICATIONS

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AEROSPACE SCIENCE & ENGINEERING

Welcome Message

Maj. Gen. Rehan Abdul Baqi HI(M) Retd.
Vice Chancellor
Institute of Space Technology

On behalf of the organizing Committee, I feel honored to welcome you at the Seventh International Conference on Aerospace Science (ICASE 2021), organized in collaboration with Belt and Road Aerospace Innovation Alliance (BRAIA) at Institute of Space Technology, Islamabad, Pakistan from Dec 14-16, 2021.

The International Conference on Aerospace Science and Engineering ICASE is a regular biennial conference that offers an international platform to all the researchers, academicians, scholars, entrepreneurs and space enthusiasts to contribute to space advancement through sharing of emerging technologies, experiences, latest breakthroughs and developments across the globe in the fields of space science, technology and application. It provides a great opportunity to all the participants to interact and explore the latest trends and themes in the world of Aerospace Engineering. ICASE 2021 envisages bridging the gap between industry and academia, seeding new collaborations with the mutual goal of space advancement.

With the theme of 'Emerging Technologies in Aerospace Engineering and Geographic Information Science', ICASE 2021 envisages leveraging invaluable knowledge of the leading experts to enlighten the participants with latest research outcomes and innovations. Owing to international COVID-19 pandemic, ICASE 2021 has been planned in hybrid mode, to ensure that maximum number of space enthusiasts can be a part of this high-level platform from all parts of the world.

ICASE 2021 offers a diverse blend of thematic areas including Aeronautics and Astronautics, Satellite Technology, Information & Communication Technologies, Positioning, Navigation & Timing, Geographic Information Science, Remote Sensing & Photogrammetry, Environment & Climate, Applied Physics & Mathematics, Astronomy, Astrophysics & Astrobiology and Space Law, Management & Outreach.

Highlight features of Seventh International Conference on Aerospace Science and Engineering (ICASE-2021) include Technical Sessions, Plenary Sessions, Leaders' Session, Panel Discussions, Workshops & Trainings, Meet the Scientist Forum, Forum 360, STEM Education, STEP Stakeholders' Forum, Scientific Networking Session, Science at Glance Session, Emerging Technologies Summit, Product & Poster Exhibition, Symposiums, GSA Summit, Star Gazing and Heritage Visit. ICASE holds unique significance in its heritage and history of setting up a high-level platform. ICASE 2021 hosts over 65 national and international speakers from up to 19 countries.

The organizing committee is thankful for the participation of international and national noteworthy experts of the scientific community including academicians, researchers, professionals, and entrepreneurs joining the conference in-person and through online medium. Their esteemed presence has added value to the conference and shall benefit the participants

through broadening of their concepts regarding Aerospace Science and Engineering.

The organizing committee is also thankful to the dignitaries, research paper presenters, attendees, exhibitors, conference chairs and co-chairs for their participation in the conference.

The organizing committee acknowledges and extends its gratitude for the sincere support of its partners and sponsors including Institute of Electrical and Electronics Engineers (IEEE), Higher Education Commission of Pakistan (HEC), BRAIA, Space and Upper Atmosphere Research Commission (SUPARCO), Inter Islamic Network on Space Sciences & Technology (ISNET), Pakistan Civil Aviation Authority (PCAA), COMSTECH, KRL, NESCOM and Space Generation Advisory Council (SGAC).

We wish all participants, stakeholders, partners and sponsors a fabulous experience full of knowledge, intellect and innovation at ICASE 2021 at Institute of Space Technology, Islamabad, Pakistan.

Maj. Gen. Rehan Abdul Baqi ®
Vice Chancellor
Institute of Space Technology

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Conference Brief

Secretary ICASE

Dr. Najam Abbas Naqvi

Institute of Space Technology

Institute of Space Technology, being the pioneer institute in Aerospace Science & Engineering, envisioned an international forum wherein scientists, researchers, engineers, academicians, private and public industry professionals, entrepreneurs, and students from all across the globe could interact and share the latest research trends related with Space Science, Technology and its Applications. Consequently, the first International Conference on Aerospace Science and Engineering (ICASE) was organized in 2009. Since its inception, ICASE is a regular biennial conference of IST and provides a platform to share research experiences, foster academia-industry linkages, and evaluate the latest findings in the emerging disciplines of Space Science and Technology.

The Sixth ICASE held in 2019, organized in collaboration with Belt and Road Aerospace Innovation Alliance (BRAIA), featured Plenary Sessions, Panel Discussions, Technical Sessions, Poster Presentations, Workshops, and Training, Exhibition and Technology Marketing Seminar, Forum 360, Leaders' Session and STEP Forum. A total of 120 research papers and posters were presented by national and international participants. Renowned researchers, scientists, and engineers were invited as keynote speakers and guests from Higher Education Institutes and industry from 14 countries, including USA, Spain, France, Austria, Finland, Serbia, Sudan, Jordan, UAE, Oman, China, Nepal, Sri Lanka, and Malaysia.

Owing to Pandemic, the Seventh International Conference on Aerospace Science and Engineering (ICASE 2021) is planned in hybrid medium, with the theme of 'Emerging Technologies in Aerospace Engineering and Geographic Information Science'. The conference features 45 international and national speakers, joining to share their research breakthroughs and latest trends in the field of Aerospace Science and Engineering. With a total of 25 technical sessions covering different tracks of Aerospace Science and Engineering ICASE 2021 also features Panel Discussions, Product Exhibition, Heritage Visit, Workshops and Trainings. ICASE 2021 hosts global participation from a wide range of countries including, Spain, Morocco, France, Belgium, Netherlands, Croatia, Italy, Niger, Latvia, Egypt, Turkey, Jordan, Saudi Arabia, Iraq, China, Indonesia, Philippines, Japan and New Zealand, to share latest research trends in the space sector.

Dr. Najam Abbas Naqvi
Secretary ICASE 2021

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Organizer & Host

Institute of Space Technology

a) Institute of Space Technology

The past century has been host to many technological advancements resulting in a gradual progression towards the betterment of society. Space sciences are part of this technological advancement and in view of its crucial role in advancing the scientific domain of Pakistan, in the year 2002 an educational institution was setup with a vision to produce professionals with specialized education in the domains of space science, technology and applications, to set a foundation for scientific advancement and bring our nation at par with the international community. Thus, Institute of Space Technology came into existence in September 2002, offering undergraduate degrees in Aerospace Engineering and Communication Systems Engineering as its core disciplines. After almost 2 decades, IST now offers graduate and baccalaureate programs in Aerospace, Avionics, Electrical, Mechanical, Materials Science & Engineering, Computer Science, Space Science, Physics, Remote Sensing & GISc, Astronomy & Astrophysics, Global Navigation Satellite, Systems (GNSS) and Applied Mathematics & Statistics.

IST is the first academic institution of Pakistan that initiated the small satellite development program. Through utmost dedication of the faculty and students, IST launched iCUBE-1, The first CubeSat of Pakistan on November 21, 2013. Through up-to-date curriculum incorporated with latest findings, state-of-the-art equipment for hands-on experience and qualified professionals with specialized expertise in their fields, IST has managed to hold high standards in its education and research outputs. Institute of Space Technology focuses on producing professionals with up-to-date knowledge of latest research trends and technological advancements in the world of engineering and sciences. IST has a legacy of organizing various international and national events, activities, and conferences that enable international and national collaborations between the academic and industrial world of space technology.

b) National Center of GIS & Space Applications

National Center of GIS and Space Applications (NCGSA), a project of Higher Education Commission (HEC) of Pakistan, led by Institute of Space Technology, is a consortium of seven research laboratories in seven Higher Education Institutions of Pakistan. NCGSA encompasses endeavors that strive to achieve and sustain human, technological, research, and entrepreneurial capacities in the areas of space science, technology, and its applications.

NCGSA research labs encompass Spatial Decision Support Systems Lab, Space & Astrophysics Research Lab, GNSS & Space Education Research Lab, Small Satellite Technology Research Lab, Agricultural Remote Sensing Lab, GIS & Space Application in Geosciences Lab and Remote Sensing, GIS & Climatic Research Lab in Quetta, Islamabad, Faisalabad, Peshawar and Lahore respectively.

The specialized research domains of NCGSA includes Geo Forensic, Geo Health and Geo hazards, Mineral Inventory, Theoretical, Computational and Observational Astronomy & Astrophysics, Space Education, Outreach and Capacity Building, GNSS Research, Development and Applications, Small Satellite Development, Capacity Building in Space Sector, Remote Sensing for Agriculture, Geological Applications of GIS and Remote Sensing, Water and Forest Resources, Climate and Environment, Land Use, Land Cover and Urban Planning.

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Conference Highlights

(Sessions Details)

1. Technical Sessions

2. ICASE 2021 Plenary Session

3. Thematic Plenary Sessions

   a. Aeronautics & Astronautics
   b. Global Navigation Satellite Systems & Space Weather
   c. Remote Sensing & Geographic Information Science

4. Special High-level Session

   a. Session on Space Science, Technology & its Applications for Socio-economic Development
   b. Space Science & Technology Cooperation Session
   c. Science Diplomacy Session

5. Summits

   a. Summit on the Role of HEC & National Centers in Emerging Technologies
   b. Summit on Geographic Information Science & Space Applications

6. Symposiums

   a. Symposium on Geographic Information Science & Space Application
   b. Symposium on Global Navigation Satellite Systems

7. Panel Discussions

   a. Space Law, Management & Outreach
   b. Global Navigation Satellite Systems & Space Weather
   c. Remote Sensing & Geographic Information Science
   d. Small Satellite Technology

8. Forums

a. Meet The Scientists
b. STEM Education
c. STEP Stakeholders' Forum

9. Workshops and Trainings

a. Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection
b. Workshop on Small Satellite (CubeSat) Design for Earth Observation Applications
c. Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing
d. Workshop on Geomagnetism & Ionosphere
e. Workshop on Optical Remote Sensing & Geographic Information Science

10. Leaders' Sessions

a. Special Session with Vice Chancellor – IST
b. Special Session with Dean & Head of Departments of IST

11. Research Poster Display

12. Product Exhibition

13. Scientific Networking Session

14. Star Gazing & Gala Dinner

15. Cultural Visit & Sight Seeing

Technical Sessions

The Technical Sessions at the Seventh International Conference on Aerospace Science and Engineering (ICASE 2021) include paper presentations by up to 100 researchers, in 25 technical sessions in 10 conference tracks. Shortlisted through a blind peer review, each presenting author shall present a 20-minute presentation on his research in the respective domain, followed by a Q&A session by the Chair, co-chair and audience. Papers recommended by the Chair & Co-Chair shall be published in IEEE Xplore.

ICASE 2021 Plenary Session

Plenary Sessions ICASE 2021 feature highly resourceful talks on the theme of ICASE 2021, i.e. Emerging Technologies in GIS and Space Applications. National and international leading experts of the scientific community, joining ICASE as keynote speakers, will deliver these talks. Participants will learn about the latest developments and emerging trends in different domains of Aerospace Science and Engineering.

Thematic Plenary Sessions

Thematic Plenary Sessions will include insightful talks by keynote speakers renowned in the fields of Aeronautics & Astronautics, Global Navigation Satellite Systems & Space Weather and Remote Sensing & Geographic Information Science, in dedicated sessions. National and international speakers will enlighten the participants with the latest development and breakthroughs in the fields of Aerospace, GNSS & RSGIS. Participants will learn about latest research and the potential future of development and potential in these streams.

Special High-level Session

Dedicated sessions on the most pertinent topics of the twenty first century including Space Science, Technology & its Applications for Socio-economic Development, Cooperation in Space Science & Technology and Science Diplomacy are planned during the 3-day conference.

A specialized session with President of Islamic Republic of Pakistan and Chancellor of Institute of Space Technology, Dr. Arif Alvi and international and national keynote speakers at ICASE 2021 will focus on the multi-faceted approaches for socio-economic development through leveraging space science and technology.

The Space Cooperation Session will host International and national representatives of multi-national organizations in the space sector wherein the vision, achievements and contributions of their respective organizations shall be presented.

Science Diplomacy Session will encompass talks by the representatives of the national and international organization, and the use of scientific collaborations among nations to address common problems and to build constructive international partnerships.

Summits

Summit on the Role of HEC & National Centers in Emerging Technologies will be a peak into the technology and research future of Pakistan under the umbrella of most research intensive initiatives of Pakistan. Summits at ICASE 2021 will include detailed brief of emerging technologies national centers, their vision and strategy, shared by their respective project directors.

Summit on Geographic Information Science & Space Applications will showcase the affiliated research labs of NCGSA wherein the participants will learn about the progress of national research labs their efforts for socio-economic development of the country through dedicated research in different domains of GIS & Space Applications.

Symposiums

ICASE 2021 includes symposiums on Geographic Information Science & Space Application and Global Navigation Satellite Systems. The symposiums will be hybrid sessions, wherein the invited guests will deliver in person and online talks on the cutting edge research in the domains of GIS and GNSS. The talks will address the growth in GIS and GNSS technologies, and enlighten the participants about potential future applications in the specialized domains of space technology.

Panel Discussions

Panel Discussions at ICASE 2021 will feature a learning and interactive platforms wherein the participants can engage in a dialogue directly with the subject matter experts on various different tracks of Aerospace Science and Engineering including Global Navigation Satellite Systems & Space Weather, Space Law, Management & Outreach, Remote Sensing & Geographic Information Science and Small Satellite Technology. National and international experts of scientific community will discuss the challenges and future of space applications in the specialized domains.

Forums

ICASE 2021 provides forums to young enthusiasts, academic leaders and private and public organizations to interact with leading scientists working in Aerospace Science and Engineering.

Meet the scientist forum will provide an opportunistic platform to the students of schools and colleges to meet industry and academia professionals working in the space sector and get firsthand knowledge about the stakes, responsibilities, career paths and potential future in these specialized career tracks.

STEM forum will be a dedicated forum for the Principals/Vice Principals/STEM faculty of schools and college, wherein the participants can engage in a dialogue with international and national guests about the importance of STEM education, interactive teaching techniques, career tracks in STEM and the importance of STEM for a more sustainable and prosperous future for the mankind.

These forums will provide an opportunistic platform to the Space Technology Education and Popularization initiatives within Pakistan to showcase their initiatives vision, outputs and achievements to the conference participants. Potential collaborations, academic and professional opportunities between the participants and presenters shall also be discussed during the session. Workshops and Trainings.

Workshops and Training

To further the goal of building scientific capacity of Pakistan and strengthen technological leadership of the country, ICASE 2021 features five specialized hands-on trainings and workshops conducted by National and International experts. The workshops will vary from Celestial Object Detection to Optical Remote Sensing & GIS with hands-on training and series of lectures.

a. Workshop on Small Satellite (CubeSat) Design for Earth Observation Applications
b. Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection
c. Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing
d. Workshop on Geomagnetism & Ionosphere
e. Workshop on Optical Remote Sensing & Geographic Information Science

Leaders' Sessions

Leaders' Sessions at ICASE 2021 are and interactive session among the Vice Chancellor, Dean and Head of Departments of the host institute and the invited keynote speakers. The session will serve as a forum to discuss prospective collaborations and linkages, academic and research opportunities and future trends in the areas of space science, technology and its applications.
Research Poster Display.

Research Poster Display

Poster Displays at ICASE 2021 are designed to provide a platform to researchers to present their research to the conference audience. Up to 12 research posters will be presented in this session. Affiliated labs of NCGSA shall also display their lab's vision, research outputs and achievements. Conference participants will be able to explore and interact with the presenters to discuss their research findings, methodologies and applications.

Product Exhibition

A product exhibition for the public and private industries developing software and hardware products in the domains of space science, technology and its applications, has been designed during ICASE 2021. The representatives of these industries shall showcase their products and identify potential business opportunities amongst the national and international conference audience.

Scientific Networking Session

ICASE 2021 features a Scientific Networking Session that encompasses a unique opportunity to connect participants with invited national and international keynote speakers. Academicians, industrialists, public and private organization representatives and other attendees of the conference shall be able to interact one-on-one with the speakers and gain information and resources on potential academic and research opportunities.

Star Gazing & Gala Dinner

A wonderful night of star gazing and a formal dinner shall be yet another eventful evenings of the conference. The invited speakers will entertain themselves through state-of-the-art telescope for stargazing followed by a Conference Gala Dinner for networking and enjoying delicious cuisines of Pakistan.

Cultural Visit & Sight Seeing

To promote cultural exchange and help enhance cross-cultural understanding, an excursion visit is planned for the national and international keynote speakers. The visit will provide an insight to the living of Pakistan, enriching understanding of local values and showcasing the heritage of Islamabad. This will be followed by sightseeing to showcase capital's serene landscape.

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Partners & Sponsors

Institute of Space Technology

Higher Education Commission of Pakistan (HEC)

The Higher Education Commission of Pakistan is an independent, autonomous, and constitutionally established institution responsible for primary funding, overseeing, regulating, and accrediting the higher education efforts in Pakistan.

Institute of Electrical and Electronics Engineers (IEEE)

IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities.

Belt and Road Aerospace Innovation Alliance (BRAIA)

The Belt and Road Aerospace Innovation Alliance (BRAIA), initiated by Northwestern Polytechnical University (NPU) and Chinese Society of Astronautics (CSA), is an international organization with Northwestern Polytechnical University serving as its Permanent Secretariat. Comprising of 51 members, BRAIA enhances the international cooperation on aerospace technology and application with focus on promoting the substantial cooperation among BRAIA members in talent cultivation, scientific research, technology development and applications, etc.

Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)

Established by the Government of Pakistan, Space and Upper Atmosphere Research Commission, SUPARCO is the National Space Agency of Pakistan, mandated to conduct research and development work in the field of space science, technology and its applications for peaceful purposes and socio economic uplift of country. SUPARCO has a strong element of international cooperation and strongly believes in peaceful uses of space science & technology for the well-being of humanity.

Pakistan Civil Aviation Authority (PCAA)

Pakistan Civil Aviation Authority (CAA) is a public sector autonomous body working under the Federal Government of Pakistan through Aviation Division Cabinet Secretariat. CAA provides promotion and regulations of Civil Aviation activities and an infrastructure for safe, efficient, adequate, economical and properly coordinated Civil Air Transport Service in Pakistan.

Inter Islamic Network on Space Sciences & Technology (ISNET)

Inter Islamic Network on Space Sciences & Technology, ISNET is an inter-state, non-political and non-profit agency. It is an inter-governmental organisation constituted under the umbrella of COMSTECH. ISNET serves as a unified agency for development of science and technology in the Muslim world, providing necessary facilities including human and material resources for research and development in space technology.

COMSTECH

COMSTECH is the Ministerial Standing Committee on Scientific and Technological Cooperation of the Organization of Islamic Cooperation, OIC. COMSTECH has a mandate to strengthen cooperation among OIC Member States in science and technology (S&T), and enhance their capabilities through training in emerging areas, undertake follow-up-actions and implementation of the resolutions of the OIC, and to draw up programs and submit proposals designed to increase the capability of the Muslim countries in science and technology (S&T).

Khan Research Laboratories (KRL)

Named after Pakistani nuclear physicist and metallurgical engineer, Dr. Abdul Qadeer Khan, Khan Research Laboratories, KRL, is a federally funded, multi-program national research institute and laboratory site in Pakistan.

National Engineering & Scientific Commission (NESCOM)

NESCOM is a civilian research organization that administers several Pakistani defence development programs.

Space Generation Advisory Council (SGAC)

Space Generation Advisory Council, SGAC, is a global non-governmental, non-profit organization and network which, in Support of the United Nations Programme on Space Applications, aims to represent university students and young space professionals to the United Nations, space agencies, industry, and academia.

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Conference Exhibitors

Institute of Space Technology

FloatSat Research Group – UCP, Lahore

The University of Central Punjab (Pakistan) and the University of Wurzburg (Germany) are working in collaboration to extend the functionality of the FloatSat (floating satellite) system. This system is utilized by students as well as researchers/professionals to get familiar with basic satellite subsystems. Furthermore, this advanced system is also used to develop and test different attitude control algorithms and strategies for small satellites in an almost frictionless environment similar to that in space. The FloatSat system mainly consists of a mechanical structure that contains the basic satellite subsystems. This structure is placed into a hemisphere shell that is floating inside a spherical air-bearing unit. The air bearing unit requires compressed air input. In order to monitor and command the FloatSat, a ground station computer is used to communicate via Bluetooth or the Wi-Fi module available in the satellite through the commanding and telemetry display tool. Utilizing the FloatSat platform students can design and evaluate various space missions such as solar panel deployment, sun tracking, satellite rotation control, satellite speed, and velocity control, visualization of IMU (Inertial measurement unit) data in real-time, satellite docking, etc.

Cogent Industries SMC PVT LTD

Cogent Industries Limited provides sophisticated engineering technology solutions, for a multitude community of industries serving defense, public and private sectors. With in-depth experience in the consultation, design and integration into various projects Cogent has a diverse and the state-of-the-art portfolio in cables, connectors and interconnect solution; electronic components; soldering, desoldering and reworking; industrial computing and displays; test measurement; EV charging stations; industrial equipment, material and tools.

Survey of Pakistan

Survey of Pakistan, which emerged as a successor to pre-partition Royal Survey of India, is a National Surveying and Mapping Organization of the country. It is primarily responsible for all sorts of topographical land surveys of cis-frontier areas of the entire country. The basic products include map sheets on scale 1:50,000 and 1: 250,000.

The department is actively participating in the national development projects and thus fulfilling the ever-growing surveying and mapping demands of various government / semi-government and autonomous

bodies. The geodetic data prepared and maintained by the department is matchless in its accuracy and use.

Over the past years, the department has taken a milestone turn by gradually switched over to surveying and mapping using modern techniques, methods and equipment. This resulted in the outstanding capability of using and manipulating topographical data to develop a wide range of applications including Geographical Information System.

Peoples Steel Mills

Peoples Steel Mills Ltd is a world class alloy and special steel manufacturer plant located in Karachi, Pakistan. It was set-up by the Government of Pakistan in 1975 with Japanese assistance.

In order to keep pace with emerging technologies, the plant was upgraded in 1996 through a comprehensive balancing & modernization programme with the technical assistance of VAIS, INTECO and Bohler of Austria. The plant is now equipped with modern melting, refining, degassing, electro slag re-melting and necessary casting, rolling and forging facilities with an annual capacity of 70,000 mt. Product quality is assured through modern material testing facilities and well trained staff.

In addition to manufacturing & supply of quality steels Peoples Steel is extending its expertise in the fields of Material Testing & Analysis, Industrial Project & Services and Refractory Materials & Services.

Dr. A. Q. Khan Research Lab

Named after Pakistani physicist and metallurgical engineer, Dr. Abdul Qadeer Khan, Khan Research Laboratories, KRL, is a federally funded, multi-program national research institute and laboratory site in Pakistan.

Space & Upper Atmosphere Research Commission

Realizing the importance of Space Science and Technology applications for sustainable national development, the Government of Pakistan established Pakistan Space and Upper Atmosphere Research Commission. Being the National Space Agency of Pakistan, SUPARCO is mandated to conduct research and development work in the field of space science, technology and its applications for peaceful purposes and socio economic uplift of country. Its headquarter is located at Islamabad and technical facilities are spread over Karachi, Lahore, Multan, Quetta, Peshawar and Gilgit. It has state-of-the-art research, development and manufacturing facilities of satellite manufacturing, space sciences, technology and applications.

Space Generation Advisory Council (SGAC)

Space Generation Advisory Council, SGAC, is a global non-governmental, non-profit organization and network which, in Support of the United Nations Programme on Space Applications, aims to represent university students and young space professionals to the United Nations, space agencies, industry, and academia.

Small Satellite Technology Research Lab, NCGSA

SSTRL is one of the seven state-of-the-art research lab of the National Center of GIS & Space Applications. SSTRL focuses capacity building in the field of small satellite technology while providing opportunity to Pakistani students of carrying out space experiments through SUPARCO and international collaboration. SSTRL also works in the domains of Joint Mission to Plan, Design and Develop a 3U CubeSat and Remote Access of IST Ground Station.

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Conference Tracks & Themes

Institute of Space Technology

Aeronautics & Astronautics

1. Aero and Astro-dynamics
2. Aerospace Structures
3. Flight Mechanics
4. Aero Vehicle Design & Operations
5. Aeroacoustics
6. Avionics Systems
7. Guidance, Navigation & Controls
8. Propulsion and Power Systems
9. Electric Aircrafts and Electric Engines
10. Rocket Engines and Rocket Propulsion
11. Thermo-physics and Thermodynamics
12. Aviation Management
13. Space Missions, Systems and Architecture
14. Aerospace Design Optimization
15. Unmanned Aerial Vehicle Systems and Technologies
16. Autonomous Aerospace Vehicles
17. Lighter Than Air Aerospace Systems
18. Space Exploration and Future Space Mission

Satellite Technology

1. Satellites Technology and Applications
2. Electrical and Electronic Systems for Space Applications
3. Peripheral Electronics, Data Handling and Signal Processing
4. Communication Systems and Technologies
5. Antennas, RF/Microwave Systems, and Propagation
6. Space Missions, Systems and Architecture
7. Systems Engineering and Subsystem Design
8. Systems and Technologies for Cube-Sats
9. Satellite Development and Manufacturing
10. Assembly and Integration Technologies
11. Space Operations and Ground Support
12. Satellite Software and Autonomy
13. Satellite Constellation Design and Management

14. Emerging concepts in Electrical and Electronics Engineering
15. Cybersecurity for Space Systems
16. Frequency Spectrum Allocation Management
17. Satellite Technology Regulations

Information & Communication Technologies

1. Computer Theory and Algorithms
2. Networking theory & Technologies
3. Wireless Communications
4. Knowledge Management & Decision Making
5. Big Data and Cloud Computing
6. Data Mining and Data Fusion
7. Parallel and Distributed Computing
8. Information & Data Security
9. Cryptography
10. Artificial Intelligence
11. Machine Learning
12. Computer and Mission Vision
13. Neural Networks
14. Robotics and Automation
15. Internet of Things (IoT)
16. Smart and Safe Cities
17. Virtual and Augmented Reality
18. Systems & Software Engineering
19. E-Commerce and E-Governance
20. Information and Communication Technologies for Sustainable Development

Positioning, Navigation & Timing

1. Navigation, Estimation and Tracking Methods
2. Ranging and Positioning Techniques
3. Aircraft and Spacecraft Navigation systems
4. Interplanetary Missions and Navigation
5. Navigation in Urban Environment
6. Guidance, Navigation and Controls

7. Control Theory, Analysis and Design
8. Control System Design and Implementation
9. Command and Control Systems for Space
10. Sensors and Embedded System Design
11. Autonomous Control and Unmanned Systems
12. Global Navigation Satellite Systems (GNSS)
13. Position Determination Using GNSS
14. Software and Hardware GNSS Receivers
15. GNSS Performance and Integrity Measures
16. GNSS Augmentation Systems
17. Applications of GNSS (Space Weather, Aviation etc.)
18. Interference and Spoofing Technologies and Countermeasures
19. Inertial and Integrated Navigation Systems
20. Navigation Sensors Fusion
21. Precision Agriculture
22. Smart Transportation Systems
23. Applications of Precise Timing
24. Aerospace Robotics and Unmanned/Autonomous Systems

Geographic Information Science

1. Earth Observation, Atmosphere and Environment
2. Cartography & Geo-visualization
3. Topography, Geology & Geomorphology
4. Spatial & Spatiotemporal Modeling and Surveying
5. Spatial Data Structures & Algorithms
6. Spatial Decision Support System
7. Image Processing and Information Extraction
8. GIS Innovations for Sustainable Development
9. Web GIS, Open-Source GIS and Geospatial Web Services
10. Climate Changes and Global Environment
11. Urban Analytics & Smart Cities
12. Big Data, IOT and Machine Learning in Geoinformatics
13. Advances in geoinformatics
14. Geostatistics

15. Applications of geoinformatics

Remote Sensing and Photogrammetry

1. Remote Sensing Instruments, Sensors and Systems
2. Image and Signal Processing for Remote Sensing
3. Data Acquisition and Information Extraction
4. Optical and Radar Remote Sensing
5. Multispectral / Hyperspectral Remote Sensing
6. Geometric Enhancement and Spatial Filtering and Masking Techniques
7. Airborne Sensors and Systems for Remote Sensing
8. Advancements in Remote Sensing
9. Remote Sensing of Clouds, Atmosphere and Oceans
10. Photogrammetry and Its Applications
11. Photogrammetric Procedures, Instruments and Sensors
12. Applications and Advancements in Photogrammetry
13. Coordinate Systems in Photogrammetry

Environment & Climate Science

1. Environmental Chemistry
2. Biodiversity, Conservation & Management
3. Biomass & Carbon Cycle
4. Pollution Monitoring and Management
5. Climate Change Monitoring and Mitigation
6. Disaster Risk Reduction
7. Waste Management
8. Water Resource Dynamics
9. Meteorology, Precipitation & Clouds
10. Alternate Energy Methods
11. Green Initiative and Products
12. Consumption, Human Needs, and Climate Change
13. Climate Change and Sustainable Development

Applied Physics and Mathematics

1. Applied Physics (Modeling, Analysis and Computation)
2. General Physics and Physics of Matter
3. Applied Solid State Physics
4. Condensed Matter and Statistical Physics
5. Computational Physics
6. Applied Nuclear Physics
7. Modern physics
8. Nano-sciences and Technologies
9. Biophysics and Biophysical Chemistry
10. Materials Science & Engineering
11. Nanotechnologies, Components and Instrumentation
12. Algebra, Number theory and Analysis
13. Applied Computing and Information Systems
14. Applied Modeling and Simulation
15. Numerical Analysis
16. Mathematical and Applied Statistics
17. Probability and Stochastic Applications
18. Quantitative Methods, and Statistical Modeling
19. Differential and Partial Differential Equations
20. Fluid Mechanics
21. Heat Transfer
22. Solid and Structural Mechanics

Astronomy, Astrophysics & Astrobiology

1. Galaxies and Star Clusters
2. Variable Stars & Exoplanets
3. Black holes, White Dwarfs & Neutron Stars
4. Planets, Ionospheres, and Magnetospheres
5. Solar System
6. Cosmology
7. Celestial Mechanics
8. Gravitational, Computational, Observational and Theoretical Astrophysics
9. Solar and Stellar Physics

10. Plasma Astrophysics
11. Cosmic Rays and High Energy Astronomy
12. Dark Matter and Dark Energy
13. Interstellar matter
14. Artificial Intelligence and Data Mining in Astronomy
15. Scientific Instruments to Astronomical Instruments: Tools & Techniques
16. Astrostatistics
17. Microgravity Science & Applications
18. Astrogeology
19. Origin and Evolution of Life in Universe
20. Space Life and Habitability
21. Life Beyond Earth
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24. Bioinformatics and Biomedical Engineering

Space Law, Management & Outreach

1. International Space Laws, Policies and Treaties
2. National Space Laws and Regulatory Issues
3. Space Policy Conflicts and Challenges
4. International Cooperation for Space
5. Space Security, Stability and Sustainability
6. Peaceful Uses of Space
7. Space for All: Space Education and Awareness
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11. STEAM (Science, Technology, Engineering, Arts & Mathematics) for Space
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Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

International Keynote Speakers

Institute of Space Technology

Dr. Tamer Mekky Ahmed Habib

Research Associate Professor

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KEYNOTE: The Role of Artificial Intelligence in Spacecraft Guidance, Navigation, and Control

Profile:

Dr. Tamer Mekky is currently an Associate Professor at The National Authority for Remote Sensing and Space Sciences(NARSS) for Space Division, Spacecraft Dynamics and Control Department. He is also a technical office member at The National Authority for Remote Sensing and Space Sciences, along with being a Spacecraft Orbit Group Lead at the Egyptian Space Agency. Dr. Tamer studied from Cairo University in the field of Aerospace and graduated in the year 2000. He got his Master's degree of Science in 2003 and his Doctorate of Philosophy in the year 2009. His graduation project was on Spacecraft Attitude Determination and Control. His MSc thesis was on The Global Positioning System Application to Satellite Position and Attitude Determination and his PhD was titled New Algorithms of Nonlinear Spacecraft Attitude Control via Attitude, Angular Velocity, and Orbit Estimation based on the Earth's Magnetic Field. Dr. Tamer has developed several algorithms in his research areas of spacecraft attitude estimation, spacecraft attitude control, spacecraft orbit estimation, spacecraft orbit control and artificial intelligence. He has total of 18 papers published and accepted to be published in SCOPUS indexed journals such as, in the Journal of Engineering and Applied Science, Proceedings of 112th International Conference on Aerospace and Aviation Technology 2007, Aerospace Science and Technology and many more. He has been classified as one of the best experts in the field of spacecraft orbit by ideXlab platform and has obtained a certificate of outstanding reviewer from Elsevier, Aerospace Science and Technology Journal.

Abstract:

The main tasks of spacecraft attitude and orbit control subsystem on-board a spacecraft are to solve the problems of spacecraft rotational motion modelling, translational motion modelling, attitude estimation, attitude control, orbit estimation, and orbit control. Linear, pseudo-linear, nonlinear, optimum and sub-optimum algorithms are traditionally discussed in the literature. In addition, tuning of solution parameters is usually done manually through simulation due to complexity of the aforementioned problems. Artificial Intelligence (AI) could be used as emerging algorithms to solve the abovementioned problems. AI algorithms include but not limited to fuzzy, adaptive neuro-fuzzy, neural networks, and genetic algorithms. Using AI based algorithms has several advantages such as ability to model highly complicated mathematical models, ability to copy a certain performance of the problem solution, achieving new performance which could not be obtained using traditional algorithms, obtaining global optimum automated solutions for the tuning problem, obtaining the same accuracy levels of the traditional algorithms with faster execution time on-board the spacecraft, and ability to deal with real time obtained data in a simple effective way as well as simulation data. In addition, the structure of AI based algorithms could be updated simply according to real time obtained data to obtain better performance.

Dr. Alim Rüstem Aslan

Professor

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KEYNOTE: Small Satellite Constellations for EO and IoT applications, latest developments in Turkey and Abroad"

Profile:

Prof. Dr. Alim Rüstem Aslan is currently the Manager of Space Systems Design and Test Lab. where many nanosatellites have developed since 2007, and Chair of Rotorcraft Technologies Graduate Program. His research interests include the design, analysis and development of nanosatellites (five in orbit), manned and unmanned rotorcraft systems with prototypes, computational fluid dynamics and aerodynamics, and defense and education technologies. He obtained his Bachelors and Master degrees in Aeronautical Engineering from Istanbul Technical University (ITU). Dr. Aslan completed the Diploma Course from the Von Karman Institute Belgium in Fluid Dynamics in 1986. He received his Ph.D. from the Department of Aeronautics and Aerospace, Von Karman Institute Belgium together with Universite Libre de Bruxelles in 1991. He worked as an adjunct professor in Old Dominion University, USA during 2001-2. Prof. Dr. A. Rüstem Aslan served as the head of the Department of Astronautical Engineering at Istanbul Technical University (ITU) from 2004 - 2013.Dr. Aslan has authored/ co-authored over two hundred and forty technical publications. Dr. Aslan in addition to academic teaching and advising duties in the field of aerospace engineering, reviews papers for several international journals and acts as consultant and inspector for large scale national and industrial projects. His about sixty research projects have been sponsored by various civil and military funding agencies and industries. He has been leading many satellite projects with successful launches into orbit, including the first satellite made in Turkey. Prof. Aslan is teaching Spacecraft System Design at ITU and Air Force Academy. He is a member of IAF, founding member and vice president of the Turkish Amateur Satellite Society, AMSAT-TR (TAMSAT) and Turkish Universities Space Technologies Society (UTEB/UNISEC-TR), and UNISEC-GLOBAL. He is also the National

Panel Member in NATO STO-AVT and co-chair of the Small Satellites Research Group. Dr. Aslan, also, regularly delivers training courses on CanSat and CubeSats and gives seminars and speeches on space technologies in different institutions such as elementary and high schools, clubs, universities, retirement houses, meetings, TV programs, etc. to increase 'space awareness' of the general public.

Abstract:

During the last decade, owing to fast development times with affordable budgets the LEO smallsat constellations for various applications has become the main trend. The LEO constellations with 1000+ space segments have started with EO applications, followed by weather sensing and AIS. However, today the greatest number of LEO satellites are up there to provide fast and uninterrupted internet to anywhere on earth. Therefore, communication applications of various transmission speeds are taken over, as was always. Turkey has also started to form such constellations for EO and IoT purposes. Development and operation of such large constellations require different approaches. The present talk will review the status and state of the art for such constellations with examples including work being done in Turkey.

Dr. Christine Marie Eugenie Amory

Senior Scientist

Sorbonne Université, Ecole polytechnique,Institut Polytechnique de Paris, Université Paris Saclay, Observatoire de Paris, CNRS, Laboratoire de Physique des Plasmas (LPP), France

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KEYNOTE: Training on GNSS and Space Weather in Africa in the framework of the North-South scientific network GIRGEA

Profile:

Dr Christine Amory-Mazaudier is professionally qualified in the fields of Computer Science (Master), Administration (MBA) and Physics (Master, PhD and 'Thèse d'Etat'). She is currently a senior Scientist at Sorbonne Universities and was Staff Associate at ICTP (International Centre for Theoretical Physics) from 2014 to 2020. She worked at CNRS (National Centre for Scientific Research) from 1978 to 2014. Between 1978 and 1989, Dr Amory-Mazaudier conducted research in various fields of the Earth's environment, and presently on the Sun Earth relations and Space Weather. Her scientific work has led to 202 publications, 134 scientific papers, 37 proceedings, 28 technical reports, 2 doctoral theses and a book. Dr Amory-Mazaudier has been in charge of young researchers and has trained 10 master students and 42 PhD students in various countries of Europe, Africa, Asia and USA. In 1995, she founded the IGRGEA (International Group of Research in Geophysics Europe Africa www.girgea.org), based upon the practice of sharing. This group develops research on the connections between the Sun and the Earth, throughout Africa and also Asia since 2005. In the framework of the International Heliophysical Year (IHY) and the International Space Weather Initiative (ISWI) projects, she was in charge of the survey of GPS networks in Africa and she is a member of the ISWI steering committee-United Nations. She received awards from USA, Africa, Europe and Asia.

Abstract:

This paper presents the successful setting up of a research and teaching network for space weather in developed and fragile countries. This development took nearly a quarter of a century with the help of international cooperation. Numerous studies have been developed in different domains of Space Weather concerning the impact of solar events on the ionosphere and the Earth's magnetic field, ionospheric electric currents and the induced currents in the ground (GIC) Other studies have also been conducted on climate change, lightning and the movement of tectonic plates. We underline the importance of Global Navigation Satellite Systems [GNSS] for the development of space weather research and capacity building during the last decade

Dr. Andres Calabia Aibar

Associate Professor / Visiting Professor

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KEYNOTE: Build Geodetic Space Weather Research: Coupling processes between magnetosphere, thermosphere and ionosphere

Profile:

Andres Calabia is a recognized academician and accomplished professional, skilled in topics of space geodesy, navigation, and remote sensing, and with a broad range of analytic techniques, including data analysis and algorithm development. His research interests focus on upper atmosphere environments and coupling between Earth and space weather, the repercussions of these environments on satellites, and the utilization of geodetic techniques to interpret the planetary variability, and to test, validate, and develop geophysical models. In his early career, he has worked as a Geomatics Engineer in Spain and the UK. Then, he completed his Ph.D. at Shanghai Astronomical Observatory, Chinese Academy of Sciences, China, and a postdoctoral position at the University of Colorado Boulder, USA. Dr. Calabia has made significant contributions with a number of original results, including 20 peer-reviewed SCI journal papers, and several conference proceedings and book chapters, with more than a hundred citations and an H-index of over 9, according to Google Scholar. He has been committed to investigating upper-atmosphere variations from satellite measurements and obtained a number of important innovative achievements in the field of Space Geodesy and Solar-Terrestrial sciences. Dr. Calabia discovered that high-resolution thermospheric variations due to solar-wind and magnetospheric forcing could be retrieved from GNSS (Global Navigation Satellite System) precise orbit products. Moreover, Dr. Calabia has established important international collaboration links with European countries, helping to expand scholarly ties and promoting international academic cooperation between universities. In addition to his great commitment to research and teaching, he has been extremely active in the international community, chairing the Join Study Group 1 “Coupling processes between magnetosphere, thermosphere, and

ionosphere" of the International Association of Geodesy Global Geodetic Observing System Focus Area Geodetic Space Weather Research, served as Guest/Associate Editor and per-reviver for several international journals, membership of international associations, and Session-Chair/ Exhibitor-Booth in several international conferences.

Abstract:

The connection between solar drivers and the Earth's magnetosphere, ionosphere, and thermosphere (MIT) phenomena in the upper atmosphere is very complex and dependent on many processes, including energy-absorption, ionization, and dissociation of molecules due to variable X-ray and Extreme Ultra Violet (EUV) solar radiance. Moreover, the variable solar wind plasma combined with a favorable alignment of the Interplanetary Magnetic Field (IMF) can produce auroral particle precipitation at high latitudes, causing chemical reactions and enhanced Joule heating through collisions between electrically-charged and neutral particles.

Consequences of upper-atmosphere conditions on human activity underscore the necessity to better understand and predict the effects of MIT processes and coupling, and prevent from potential detrimental impacts on orbiting, aerial, and ground-based technologies. The spatial gradients of charged particles (mostly free-moving electrons in the ionosphere) can perturb the propagation of electromagnetic radio waves employed by satellite communication systems, remote sensing imaging, and Global Navigation Systems (GNSS) measurements. The upper atmospheric expansion/contraction in response to the variable solar and geomagnetic activity produces the variable aerodynamic drag on low Earth orbiting (LEO) satellites, which makes the satellite tracking difficult, decelerates LEO orbits, reduces their altitude, and shortens the lifespan of space assets. The exponential increase in space debris (including the recent destructive events of Fengyun-1C, Iridium, and Mission Shakti) also highlights the importance of orbital tracking for the prediction and avoidance of potential collisions with orbiting satellites by space debris. Finally, ground pipelines, power grids, and electronics could be influenced by the sudden changes in the magnetic field and associated current system caused by interplanetary shocks.

Unfortunately, the MIT coupling and its resulting MIT variations under different space weather conditions are still not well understood, and the existing models are incapable of predicting the MIT variability as required, in spite of the efforts to model variations, anomalies, and climatology over the last half-century. This is largely due to the lack of comprehensive approaches for calibrating the models, and the limited quantity of both observations under various conditions in both hemispheres, and comprehensive and coordinated observations of auroral particle precipitation and ion drift / field-aligned current.

Our research aims to improve the understanding of the MIT coupling and its resulting MIT variations under various solar forcing conditions. In addition, waves from the lower atmosphere including atmospheric tides and planetary waves can feed into ionospheric electrodynamics, and consequently to the MIT system. Gravity waves can deposit momentum in the MIT, and change the mean state which then influences the wave propagation of larger waves. To that end, our tasks are to exploit the knowledge of the MIT processes by examining multiple types of magnetosphere, ionosphere, and thermosphere observations. The final outcome will help to enhance the predictive capability of empirical and physics-based models through interrelating and exploring dependencies of variability between essential geodetic variables..

Dr. Jean L. Rasson

Advisor of Geophysics research

Department of Geophysics Services & Research, M/s Royal Institute of Meteorology, B5670, Dourbes, Belgium

KEYNOTE: Introduction to Geomagnetic Observations

Profile:

Dr. Jean Louis Rasson serving as Head of Department at The Geophysical Center of Dourbes. Having a PhD. in Physics from Catholic University of Louvain, Belgium, Dr. Rasson has acquired extensive field and research experience at Royal Observatory of Belgium, National Geographic Institute and Royal Meterorological Institute. He has worked on important research projects, including 'Observation of Geomagnetic field: Novel Ways in Instrumentation for Field and Unattended Operation' and 'Application of GIS Techniques through GNSS and Geomagnetic Instrumentation'. He has 35 international publications under his name and is a member of several professional societies, including IEEE, European Geophysical Society and NewYork Academy of Sciences.

Abstract:

The talk will begin with a description of the magnetic field vector as it is perceived on Earth's surface. We know it is time and space dependent. Therefore, observing will be by spot measurements and by time series.

After a survey of the various sensors able to apprehend this physical variable, we will look at the reference frames handy to describe it. This will bring us to the different measurement set-ups including field installations.

We will then describe magnetic observatories and their network on the surface of the Earth. Slides will be devoted to the quality of measurements and how to access online data.

Dr. Mark Van Der Meijde

Professor

University of Twente, Netherlands

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KEYNOTE: Remote Sensing for Solid Earth Studies: Examples from Natural Hazards and Mineral Exploration

Profile:

Dr. Mark Van Der Meijde has a MSc degree in Earth Sciences from Utrecht University (1998) and a PhD in geophysics from the ETH Zurich, Switzerland (2003). In the past, he worked at the Dutch Seismological Institute (KNMI) and the Dutch geological survey (NITG-TNO). He started in 2003 ITC's department of Earth Systems Analysis. He is currently the head of the department of Earth Systems Analysis (ITC-ESA) and Professor in Geophysics with a focus on imaging of Earth structure, composition, and dynamics through better understanding on the use of earth observation data. In particular, his focus is on the structure and deformation of the earth due to natural processes and the added value of satellite borne geophysical sensors in it.

His research contributes to an improved understanding of the relation between Earth structure, composition, and dynamics, with a focus on quantifying the effect and impact of deformation due to natural processes. There is a strong focus on process oriented spatial modelling for both fundamental and problem-oriented research. The use of earth observation data, and in particular the added value of satellite borne geophysical sensors and their uniform spatial coverage, makes his research different from most others in this field.

Abstract:

Data from Earth observation satellites, small-sat constellations, airborne and drones is increasingly being used to study the Earth's interior, surface, and atmosphere. Of particular interest is to image and monitor the interactions between these elements. Earth deformation

studies will give information on earthquake hazards, structural control on surface deforming processes, and provide insight into the controlling deep Earth turbulent phenomena, such as mantle plumes and large-scale geodynamics. Information on these processes can be best obtained using various geophysical, geodetic and Earth observation data sources in combination with physical modelling techniques (e.g. spectral finite element modelling). Ground surface topography influences the spatial distribution of earthquake-induced ground shaking. Earth surface topography scatters and reflects seismic waves, which causes spatial variation in seismic response. We performed a 3-D simulation of two Himalayan earthquakes with the spectral finite-element method. Our results showed amplification of seismic response on ridges and de-amplification in valleys. It was found that slopes facing away from the source received an amplified seismic response, and that 98 % of the highly damaged areas were located in the topographically amplified seismic response zone.

The same approach has been used for a seismic hazard analysis which was carried out by estimating ground motion for hypothetical earthquakes in the area of Muzaffarabad, Pakistan. Our results show that, beside topography, the relative location of the source with respect to slopes also has an influence on the observed variation in ground shaking amplitudes. By integrating the mean and standard deviation of estimated ground shaking from 25 simulations, we present a seismic hazard map for the study area. The map summarizes the topographic and potential source location effect on seismic-induced ground shaking in the study area. It provides a classification from hazardous to safe in relative terms and can be used as a guide in earthquake preparedness. All the aforementioned effects are very visible when we study the 25 April 2015 Mw 7.8 Gorkha, Nepal, earthquake. The Gorkha earthquake was a special one. It remains elusive why there was only weak and limited ground shaking in Kathmandu valley. Our spectral element numerical simulations show that, during this earthquake, surface topography restricted the propagation of seismic energy into the valley. The mountains diverted the incoming seismic wave mostly to the eastern and western margins of the valley.

Remote sensing based sensors can also provide information on the imaging of Earth's composition and structure. This is of particular interest for mineral exploration studies since it gives a very complete spatial coverage compared to field-based studies. This added value is particularly present in regions that suffer from data scarcity, possibly due to limited availability of sensors and challenging terrain for fieldwork, like in the Himalayas. Our remote sensing efforts concentrate on the search for new earth resources important to civil society, through the integration of geological concepts and exploration models with earth observation and geo-information science. The focus is on geological concepts related to earth resources, geological mapping, and modern exploration methods such as: multi- and hyperspectral remote sensing, geophysics, field/lab spectrometry, and geochemistry. Case studies will be shown of

hyperspectral surveys over mineral deposits in various parts of the world, highlighting the capabilities of retrieving crucial information on the type, size and quality of the mineral deposit.

Dr. Relly Margiono

Researcher and Lecturer

Geophysics, Sekolah Tinggi Meteorologi Klimatologi dan Geofisika (STMKG), Indonesia

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KEYNOTE: The Role of Geomagnetic Observatories and their Data Quality

Profile:

Dr. Relly Margiono is a lecturer and researcher of geophysics with twelve years of experience working on the geomagnetic observatories. He works for the Agency of Meteorology, Climatology and Geophysics, Indonesia. His expertise lies in conducting geomagnetic observations, geomagnetic data processing, and geomagnetic data quality. He has experience working with and was trained by the British Geological Survey (BGS) after postgraduate study at the University of Edinburgh, which focused on geomagnetism. Dr. Relly aims to improve geomagnetic observatory data quality especially in the Asian Region to produce better geomagnetic monitoring and modelling.

Abstract:

The geomagnetic field is a fundamental, large-scale property of the Earth spanning the near-Earth environment and protecting the Earth from damaging solar radiation. The field can be measured at the Earth's surface and in space using geomagnetic observatories and satellite missions. The product of the measurement, geomagnetic data, can be used both for practical and scientific purposes. Because of that, geomagnetic data should have a high standard, and some practical guides regarding geomagnetic observation are necessary. Geomagnetic observatories play a critical role in producing magnetic data at the Earth's surface. Unfortunately, the distribution of them is uneven, and they are concentrated in the northern hemisphere. In order to fill the gap, some projects have been launched (e.g., INDIGO) to establish new geomagnetic observatories at other desired locations. In addition, understanding of observation (e.g., absolute and variation measurement) is essential to produce high data quality at the geomagnetic observatories.

Furthermore, data assessments are needed to test the data quality before being transmitted for user purposes. The sensible way to obtain good quality is to follow INTERMAGNET guidelines, the institution that advises on geomagnetic observatory data and networks around the world. In the talk, I will present an overview of the role of geomagnetic observatories in the world and a case study how to improve their data quality. Hopefully, through this presentation we will have a good understanding of the importance of magnetic observation stations and can work together to improve the quality of the data for better monitoring of the earth's magnetism.

Dr. Ali Nouh Ali Ma'bdeh

Head of GIS & RS Section

Al - Bayt University, Jordan

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KEYNOTE: The Role of Geographic Information Sciences in managing the COVID-19 Pandemic

Profile:

Dr. Ali Nouh Mabdeh is a 24 years specialist in the field of Remote Sensing, photogrammetry, GIS, and its applications in environmental issues, Mapping, security, and Disaster management. Currently Dr. Nouh is the head of GIS & Remote Sensing Section at Al-Bayt University - Jordan with ten years of previous experience as a head of The Geographic information (GIS) Office, at the National Center for Security and Crises management (NCSCM) in Jordan, and two years as a Head of the Operation and Planning Department, at (NCSCM), and three years as a Head of the strategic studies Department, at (NCSCM), Jordan. Dr. Ali has a distinguished experience working with international organizations, where he worked for one year as a GIS officer with the UN mission in Eritrea and Ethiopia in 2002. In 2007, Dr. Ali was the head of the GIS office in the United Nations peacekeeping mission in the Republic of the Congo.

Abstract:

Geographical information science has proven a great ability as an effective tool in helping decision makers take the right decisions at the right moments while handling crises issues, and offers them a great opportunity to take decision under certainty as never happened before.

During the COVID-19 pandemic, GIS has once again proven its superior ability to manage the crisis, it is about researching geographic locations, people, and the spatio-temporal dimensions of patients and those in need of health care.

The fast-updated dynamic maps and the web publishing services for GIS data which provided

by modern GIS have been considered as the most effective tool in the hands of decision-makers in terms of determining the locations of coronavirus infections, the number of people in contact with them, the population density in the area, ways to reach the infected, the best ways to provide health care to them, and the closest Health centers in the event that it is necessary to evacuation, the best means of implementing partial closures on cities and towns if necessary, the best methods of monitoring the infected who were decided to be detained in homes, and many other solutions provided by GIS to decision-makers in managing the pandemic.

Despite all the aspects of excellence presented by geographic information sciences in managing the pandemic, some aspects still need more effort, work, development and creative ideas to overcome the shortcomings and weaknesses that have appeared and still waiting for solutions in the pandemic management.

Here in this paper, we will make a comprehensive assessment of all aspects of performance provided by geographic information sciences in managing the Corona pandemic, because we are looking forward to exchanging ideas and scientific discussion about the best ways and practices to bridge the gap between what we have now and what we are looking forward as an ideal situation, especially since the Corona pandemic is not over yet, and that Corona virus cases are still increasing in some parts of the world , and that many countries of the world have begun to enter into a third or fourth wave after everyone thought that the matter was receding.

Dr. Fadia W. Al-Azawi

Assistant Professor

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KEYNOTE: Tackling and Solutions of the Climate Crisis Head On

Profile:

Dr Fadia W. Al-Azawi is an assistant professor of Remote Sensing and Image Processing at Al-Karkh University of Science, Iraq. Her academic activities cover several training courses in the field of remote sensing, laser and optics, human development, and acting as the preparatory and scientific committee for multiple conferences. She completed her PhD in Remote Sensing with image processing and her thesis was titled as, 'Water Security and challenges of the next stage in Iraq (a future study)'. Dr. Fadia has also published 6 research works.

Abstract:

Climate change describes a change in the average conditions such as rainfall, temperature, and relative humidity, in a region over a long period of time. Specialist scientists have observed Earth's surface is warming, and many of the warmest years on record have happened in the past many years.

Addressing tackling climate change and global warming require national and international action and policy changes; furthermore, individuals, and communities have a vital role to play too. Individuals in the major emitting nations can shift their day-to-day behavior and reduce their carbon footprint. Fishers, farmers, and "The effects of urbanization like cities which consume 78 % of the world's energy and produce more than 60% of all GHG emissions". Converging with climate change in dangerous ways. Can also adopt climate-friendlier practices and reduce their impact on nature-based solutions to these problem.

There are some of the direct tackling to the climate crisis to preserve a livable climate, greenhouse-gas emissions must be reduced to net zero by 2050. Bold, fast, and wide-ranging action needs to be taken by governments. But the transition to a low-carbon world also requires the participation of citizens – especially in advanced economies.

Every one of us can help limit global warming by making choices that have less harmful effects on the environment, we can be part of the solution and influence change.

Some of the suggestions to build resilience in response to climate like environmental Resilience such as air and water quality the circular economy, environmental governance, the bio economy, sustainable waste management.

Also there are some ideas policymaking for future generations: a blueprint for a green future and sustainable development.

Dr. Mounkaila Mohamed

Lecturer

University Abdou Moumouni Niamey, Niger

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KEYNOTE: Remote Sensing of Atmospheric Aerosols, Earth System Science

Profile:

Dr Mounkaila Mohamed is currently at the Department of Nuclear Physic and Chemistry of Institute of Radio-Isotopes, University Abdou Moumouni Niamey Niger as a lecturer in atmospheric chemistry, environmental data base creation and analysis and remote sensing. His research area is focused on environmental analysis using laboratory methods and remote sensing data. He completed his BS (1995) and MS (1996) in Chemistry from University of Ouagadougou Burkina Faso, and PhD (2006) from Institute of Soil Science and Land evaluation of Hohenheim University, Stuttgart, Germany. His publications include 4 articles in journals and 5 proceedings of symposia, workshops and colloquia.

Abstract:

My research interest is focused on environmental analysis using laboratory methods and remote sensing data. The Earth's surface is an important component of the Earth's climate system. The land surface is the key important layer and encompasses multiple environments interacting with each other and the atmosphere. It involves various biological, geochemical and physical processes occurring within and over these components. Modelling the Earth's system requires mathematical descriptions of these processes relating the momentum energy, and the mass (water, carbon, dust, greenhouse gases and other constituents) flux exchanges with its overlaying atmosphere. Today, hyperspectral and multispectral recorded from satellite data are easily available. A combination of optical sensors allows better monitoring and modelling the Earth's system and Climate. The retrieval of surface biogeochemical properties with the help of geographic information system tools at high spatial and temporal resolution and in wide spectral ranges from satellite images is necessary to build up a regional and global database for the use of climate modellers.

Dr. Andris Slavinskis

Associate Professor

UT Tartu Observatory, Estonia

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KEYNOTE: The History of Life, the Universe and Everything

Profile:

Andris Slavinskis is a space technology researcher interested in small & autonomous missions to asteroids & comets, mission design & simulations, software development and the electric solar wind sail. He is serving as a Co-PI of the Comet Interceptor's Optical Periscopic Imager for Comets (OPIC) instrument and the PI of ESTCube-2 which will demonstrate the plasma brake deorbiting technology. Slavinskis also coordinates the Space Imaging Simulator for Proximity Operations (SISPO) development. He also writes and edits the Space Travel Blog. Slavinskis received BSc and MSc degrees in computer science from Ventspils University College, Latvia in 2009 and 2011. For master studies, he spent an exchange semester in Lund University, Sweden and did the thesis work in Paul Scherrer Institute, Switzerland. Slavinskis received a PhD degree in Physics from the University of Tartu in 2015 on ESTCube-1 attitude determination & control. During PhD studies, he spent an year at the Finnish Meteorological Institute working together with Pekka Janhunen, the inventor of electric sail. During 2019–2021, Slavinskis was a Postdoc at Aalto University in Finland, establishing Aalto's Comet Interceptor software development & simulation activities and advancing FORESAIL-1/2 mission designs. From 2017–2018, he worked at NASA Ames Research Center, advancing the Multi-Asteroid Touring concept and developing the orbit maintenance module for Trade-Space Analysis Tool for Constellations. In 2016, Slavinskis received the IEEE Harry Rowe Mimno Award as the first author of the paper ESTCube-1 In-Orbit Experience and Lessons Learned.

Abstract:

The history of the universe spans 13.8 billion years, of the Earth –4.5 billion years, and of known life –4 billion years. This talk will travel through space time revisiting the most important events and processes providing the resources and energy for life to start and evolve.

Mr. Hamza Hameed

Team Lead - Legal

Space Generation Advisory Council (SGAC), Italy

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KEYNOTE: International Law for the Space Sector: Do international instruments promote growth and development for the space industry?

Profile:

Mr. Hamza Hameed is a Pakistani lawyer working as a Legal Consultant at UNIDROIT in Rome, Italy. His primary focus is on secured transactions law and fintech, whereby he works on the Cape Town Convention and its Protocols, with a particular focus on spacecraft financing, as well as UNIDROIT's project on Digital Assets and Private Law. He is closely involved in the activities of the Cape Town Convention Academic Project and is the Manager for fundraising and Administration at the UNIDROIT Foundation. He holds an LLB from the University of London International Programme and an Advanced LLM degree in Air and Space Law from the International Institute for Air and Space Law at Leiden University. He is also the Lead of the Legal Team at the Space Generation Advisory Council, and a member of the International Institute for Space Law. He is also a lecturer in space financing at Leiden University.

Abstract:

The space industry is predicted to be as big as $40 Billion by 2030, with large parts of this growth having come in the recent past, and expected to continue in the coming years. In order for this growth to be sustainable, it is critical that operators within the space sector follow a set of rules and regulations agreed on by the international community. In this regard, the United Nations Office for Outer Space Affairs (UNOOSA) and other international organisations have developed several international instruments, including treaties and soft law related texts, that govern the rights and responsibilities of actors in outer space.

The keynote will examine, in broad terms, the international law related rules and regulations that exist for public and private sector operators looking to conduct space activities. It will examine rules found both in public international law and private international law, while also looking at how these need to be transposed into domestic legislation. The presentation will also conduct an analysis of the international space law related treaties Pakistan is party to, and the obligations which stem from these commitments onto the space industry within our jurisdiction.

Dr. Muhammad Sharif

Advisor Science & Technology

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KEYNOTE: Exploring the Space Science Future - Together

Profile:

Dr. Muhammad Sharif is an Advisor-Science and Technology at Islamic World Educational, Scientific and Cultural Organization (ICESCO), Rabat, Kingdom of Morocco; Associate Professor at Leibniz Institute for Catalysis Rostock Germany and Adjunct Professor at University of Lahore Pakistan. Prior to joining ICESCO, Dr. Sharif was serving as Assistant Professor at King Fahd University of Petroleum and Minerals, Kingdom of Saudi Arabia. He earned his graduation from Leibniz Institute for Catalysis (LIKAT) and Institute of Organic Chemistry, University of Rostock Germany. He held various research positions within academics and industrial environments throughout his career, with major emphasis on materials synthesis and catalytic process development. Sharif is also an entrepreneur with experience in technology development and commercialization for diverse application in upstream, downstream petrochemical and construction chemical industry. Prior to his employment at King Fahd University of Petroleum and Minerals Saudi Arabia, he was also an Assistant Professor in the Department of Chemistry COMSATS Institute of Information and Technology Abbottabad Pakistan; Senior Scientist, Team Leader and Head of Bulk Chemical Labs at Leibniz-Institute for Catalysis Rostock, Germany. His research experience and expertise span over a wide range of topics in development of new materials, their application in industrial applications, Pharmaceuticals, Organic Synthesis, Applied catalysis, such as Synthetic organic & Organometallics, Homogeneous/Heterogeneous Catalysis, Catalyst Separation and Recycling, Nanotechnology, Olefin Polymerization & Oligomerization, Hydroformylation, CO2 Utilization, C-H activation. Dr. Sharif is also a member & Chartered Chemist at Royal Society of Chemistry (RSC), American Chemic Society (ACS), Saudi-American International Chemical Society, member of International Engineering and Technology Institute (IETI) and German Chemical Society. He is also a Scientific Review

Panel member for various organizations and an Expert-Reviewer Panel Member for various thesis committees at Jacobs University Bremen, Germany. Dr. Sharif has the expertise in catalyst (homogeneous, heterogeneous, nanomaterials and pharmaceuticals) synthesis development, screening and process development. He has more than 60 articles in peer-reviewed journals and 3 published/issued patents with 6 patent application filed. Dr Sharif has delivered around 200 public talks, seminars, presentations around the world, motivational talks as well as talks in different chemical industries such as Evonic Germany, Saudi Aramco, Sipchem, Halliburton, Honeywell and Dhahran Techno Valley KSA.

Abstract:

The space ecosystem is multifaceted and offers a wide variety of applications contributing directly or indirectly to achieving the Sustainable Development Goals (SDGs), especially to:

Ensure food security, boost agriculture, and reduce poverty, limit disaster risks and prevent humanitarian crises, manage natural resources and the environment, improve knowledge of the environment and degradation processes and monitor climate & weather.

The huge interest of ICESCO member states in space sciences, technology, activities, and recent developments in applications of space science in almost every field makes it pertinent to

- Invest more in formal and non-formal education and training systems in developing countries to ensure succession and meet the many challenges they face.
- Provide better awareness about the importance of space technology.
- Highlight the challenges and opportunities available in the space ecosystem.
- Engage space exploration and related industries in advancing the global space ecosystem; and Develop technical capabilities in all areas related to space science, technology, and innovation.

In developing countries, however, and particularly in the Muslim World, there is a large gap in awareness about the importance of space science in many fields, such as communications, disaster management, environmental monitoring and protection, agriculture, natural resource management, and education. These opportunities to increase national productivity and to accelerate economic growth require the development of collaboration across space-assisted

industries.

It is imperative that the developing world bridge these gaps and increase space exploration, as well as apply space technologies to economic growth across industries.

The deliberation will highlight the ICESCO perspective and highlights towards space science applications at ICASE-2021.

Dr. Abdulrahman H. Bajodah

Professor

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KEYNOTE: Generalized Dynamic Inversion Control: Achievements and Opportunities

Profile:

Dr. Abdul Rahman Bajodah is currently a professor at King Abdulaziz University, Jeddah, Saudi Arabia. Being a researcher, he specializes in atmospheric and space flight mechanics and control, robotics, dynamical system analysis and control, analytical dynamics, optimal, robust and adaptive control theory. He is the aerospace technical committee member of International Federation of Automatic Control (IFAC), senior member of American Institue of Aeronautics and Stronautics (AIAA), and a member of European Embedded Control Institute (EECI). Dr. Bajodah completed his Bachelors in Aeronautical Engineering from King Abdulaziz University and Masters, along with PhD in Aerospace Engineering from Georgia Institute of Technology, Atlanta, USA. He has published 34 articles and presented 47 conference papers.

Abstract:

The basic principles and formulations in the subject of analytical mechanics have been inspiring in the establishment and the enhancement of new ideas and concepts in the subject of dynamical system analysis, and in providing the necessary mathematical tools for developing control system design methodologies and techniques. For example, the work-energy principle played an important role in the development of Lyapunov stability theory and in energy and passivity based control system analysis and design. Similarly, the Lagrange equations of motion and the variational Hamilton principle motivated the theory of optimal control and the port Hamiltonian control approach.

A prime reason for the big influence of analytical mechanics on control system analysis and design is that the two prime objectives of controlling finite dimensional dynamical systems, namely tracking and regulation, can be casted in terms of virtual differential constraint equations that we desire to impose on the state variables of the system. The (active) control forces that work to satisfy the control system objectives by imposing these constraint equations on the system can be viewed as (passive) constraint forces on an equivalent uncontrolled system that evolves naturally in time. Determining these natural constraint forces is at the pinnacle of analytical mechanics, and trying to design the control forces as to mimic these constraint forces justifies the interesting relationship between the two subjects.

A far more recent formulation in analytical mechanics is the Udwadia-Kalaba equations of motion. The discovered set of equations of motion utilizes nonsquare (pseudo) inversion and the Greville formula for general solutions of underdetermined linear algebraic equations to model the interaction between a dynamical system and the environmental constraints on it. The Greville formula captures the orthogonality of constraint forces and generalized velocities of a dynamical system as abided by the principle of virtual work, and it models this interaction correctly for both holonomic and nonholonomic constraints.

The Generalized dynamic inversion (GDI) is a promising control system design methodology that is inspired by the Udwadia-Kalaba equations of motion and the Greville formula. By evaluating the virtual differential constraint equations along the solution trajectories of the dynamical system, the virtual constraints appear in an algebraic form that emulates how physical constraints on an uncontrolled copy of the dynamical system appear. The GDI control law is produced by generalized inversion of the virtual constraint equations and nullspace parametrization of the constraint matrix as given by the Greville formula.

The purpose of the lecture is to give an overview of GDI control and its applications in linear and nonlinear control systems, especially aerospace systems applications. The talk will also emphasize the future research directions of GDI control and how it can be utilized as a unifying and generalizing environment of several control system design methodologies, e.g., full and partial left dynamic inversion of square and nonsquare systems, eigenstructure assignment, successive loop closure, sliding mode and optimal control, and GDI adaptive and robust control augmentations.

Dr. Chen Jie

Associate Professor

Northwestern Polytechnical University, China

KEYNOTE: Preprocessing of Massive Flight Data Based on Noise and Dimension Reduction

Profile:

Dr. Chen Jie, associate professor, in 2011, he received his PhD from Northwest Polytechnic University. His recent research work has been focused in the fields of aircraft avionics system testing, fault diagnosis and health management, testability design and modern flight control methods. In recent years, he has participated in and undertook many research projects, such as National Science Fund, Shaanxi Natural Science Fund and Aviation Science Fund. More than 20 academic papers have been published in core journals which indexed by SCI and EI, and a number of awards for scientific and technological inventions/advancements were awarded by the Ministry of Industry and Information Technology and the Ministry of Education in China.

Abstract:

The integrated modular avionics system is an important part of modern aircraft. It will generate massive and diverse types of flight data during its operation. When we want to extract useful information from flight data for aircraft system fault diagnosis and life prediction, the noise and data redundancy are the first problem to confront and it will affect the selection of feature parameters. For this reason, this article chooses the wavelet threshold de-noising method to reduce the noise of raw data, and then uses the principal component analysis method to reduce the dimensionality. The results illustrate that the effects of de-noising and dimensionality reduction are effective.

Dr. Gustavo Alonso Rodrigo

Professor

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KEYNOTE: Space Debris Hazards: The Case of UPMSat-2

Profile:

Gustavo Alonso received a Master in aerospace engineering from Technical University of Madrid (UPM) in 1990, an MBA from IESE in 1998 and a Ph.D. in aerospace engineering from UPM in 2005 and joined the faculty of this university that same year, where he is currently a Professor of Space Systems Engineering and Air Transport, Directorof the UPMSat2 programme and Deputy Director of the Research Institute on Microgravity (IDR/UPM). His research interests include aerospace technologies and the environmental impact of air transport. He has published over 50 papers in JCR-indexed journals and participated in some 50 research projects funded by public institutions (EU, Spanish government) and private companies. He is a visiting professor at several Universities in Europe, America and Asia, and a former member of the Physical Sciences Working Group of the European Space Agency. He is currently Chair of PEGASUS (Partnership of an European Group of Aeronautic and Space Universities) and member of the Standing Council of BRAIA (Belt and Road Aerospace Innovation Alliance). Before joining the University in 2005, he was working for the European Space Agency, Airbus and different engineering companies occupying technical and managerial positions for 15 years.

Abstract:

Space is becoming more accessible. More countries have now the opportunity to use more or less sophisticated space assets. And it is becoming more competitive: more private organisations are getting involved not only in the development of applications based on space infrastructure, but also in the development of launchers or space exploration probes.

An undesired consequence is the proliferation of space debris. Liabilities linked to space debris (accidentally or deliberately created) will continue increasing: more launches and satellites, exponential multiplication after every collision. Debris threatens anything in space and may impact any type of mission. If debris causes damage or loss of life down on Earth, the liability is on the launching State. But what if debris causes damage in space? The situation is not clear according to the international space treaties.

UPMSat-2 is a microsatellite designed, built and operated by students from UPM (Technical University of Madrid). It was launched on September 2020. Since then, there have been many occasions when it has been about to collide with a piece of debris. The results of the analysis of the UPMSat-2 Collision Avoidance Events provided by EUSST, the European Space Surveillance and Tracking service, will be shown to illustrate the serious and real hazard that debris has become for everyone

Dr. LIU Cun-liang

Professor

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KEYNOTE: Analogy Principle for Overall Cooling Effectiveness of Composite Cooling Structures With Film Cooling

Profile:

Prof. Liu is currently a member of the ASME Gas Turbine Heat Transfer Committee (K-14), and the Head of Shaanxi Key Laboratory of Thermal Sciences in Aero-engine System. Prof. Liu, Deputy Dean of School of Power and Energy in Northwestern Polytechnical University, received his Bachelor Degree in Thermal Engineering in 2005, his Ph.D in Aeronautical and Astronautical Propulsion Theory and Engineering in 2009, both from Northwestern Polytechnical University. He works on the state of the art heat transfer and cooling technology in aero-engine and gas turbine system. His research interests mainly include film cooling, heat transfer analysis and cooling augmentation technique for turbine, heat transfer under unsteady aero-thermal conditions. Based on the self-developed transient heat transfer measurement technique with non-uniform initial temperature condition and turbulent heat diffusion models (turbulent Prandtl number distribution models), film cooling of diffuser shaped hole configurations and converging slot film hole configurations was studied to reveal the correlation rules and mechanism of their film cooling characteristics to the related aero-structure parameters. The effects and related mechanism of rib structure and cross-flow parameter in coolant channel, geometry deviation of hole structure and mainstream turbulence intensity on the film cooling characteristics were also revealed by his work. He established a new analysis method for the unsteady convective heat transfer with the spatial distribution of the changing rate of unsteady flow temperature. And based on this method, the influence mechanism of unsteady flow temperature and wall thermal boundary conditions on the temporal behaviour of turbine blade heat transfer coefficient has been revealed. He has been awarded the Humboldt Research Fellowship, the First Prize of Science and Technology Award of Shaanxi Higher Education and the Shaanxi Young Scholar Award. He has also served as Session Chair for several ASME TURBO EXPOs, and the reviewer

for top international journals in the field of heat transfer. He is the author or co-author of more than 65 papers in archival journals and conference proceedings. Nine patents have been authorized to him. He has taken part in more than 20 research projects, leading 15 of them in the past 5 years.

Abstract:

The overall cooling effectiveness, which represents the distribution of dimensionless temperature on gas turbine surface, is an important parameter for conjugate heat transfer analysis of gas turbines. Generally, it is difficult to measure the overall cooling effectiveness in engine condition. However, the overall cooling effectiveness can be measured in the laboratory by matching the appropriate parameters to those of the actual turbine blade. In this paper, the effects of adiabatic film effectiveness and Biot number on the overall cooling effectiveness were investigated with a composite cooling model by numerical simulation, in which 3-D steady RANS approach with the k–ω SST turbulence model were used. The tested plate had 8 cylinder hole rows of 30 degree inclined angle, and the internal cooling employed staggered array jet impingements. The matching performance was evaluated by comparing the results in typical engine condition and laboratory condition. The analogy principles were discussed in detail. The results showed that the overall cooling effectiveness can be matched by using suitable matching principle in different lab conditions. The theoretical analysis was verified by numerical results. The distribution and values of overall cooling effectiveness can be matched well between engine condition and lab condition by matching temperature ratio, mainstream side Biot number and blowing ratio. If the temperature ratio is mismatched, the momentum flux ratio will be an important parameter for overall cooling effectiveness, because matching momentum flux ratio can reduce the difference of the adiabatic cooling effectiveness and heat transfer ratio between engine condition and laboratory condition.

Dr. Shufan Wu

Professor

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KEYNOTE: The Development and Early In-Orbit Results of the APSCO Student Small Satellite SSS-2A

Profile:

Prof Dr Shufan Wu is an IAA correspondence member, AIAA Associate Fellow and Executive Deputy Dean of the school of aeronautics and astronautics at Shanghai Jiao Tong University (SJTU), P. R. China. He graduated from the Nanjing University of Aeronautics and Astronautics (NUAA), China with BSc, MSc, and PHD in 1990. He worked as an associate professor (1994) and full professor (1998) in NUAA. He spent 17 years in Europe working at the TU Braunschweig in Germany (1995-1996), TU Delft in Netherlands (1998-1999), Surrey University in UK (2000-2002), and the European Space Research and Technology Centre (ESTEC) of the European Space Agency (2002-2013); working throughout in aerospace research and technologies. He also worked as the Chief engineer and manager of the China-French cooperated science satellite SVOM project and the STU-2 CubeSat mission during 2013-2017 in the Shanghai Engineering Centre for Microsatellites. He moved to SJTU in July 2017 as a chair professor. His main research topics cover the guidance, navigation and control of flight vehicle, satellite system engineering, micro/nano-satellite technologies and application.

Abstract:

On Oct 14 2021, the APSCO student small satellite SSS-2A has been successfully launched into orbit from Taiyuan Launch pad, China. It is the first satellite project sponsored by APSCO-Asia Space Cooperation Organisation. It is a standard 3U Cube satellite. This paper describes the design and development, and the early in-orbit results of this student satellite project.

Dr. Zhigang Gao

Associate Professor

Northwestern Polytechnical University, China

KEYNOTE: Investigation of Modular Energy Unit with Solar Panels in CubeSat

Profile:

Dr. Zhigang Gao, associate professor of NPU, PhD degree and master supervisor, serves as the vice director of Shaanxi Engineering Research Center for Electrical Servo Systems. He is also a member of National Key Field Innovation Team of Micro-Satellite and Applications, National Joint Engineering Laboratory for Micro-Satellite Technology and Application, Shaanxi Engineering Laboratory of Microsatellites and obtained a grant "Sanqin" scholar allowance. He is also the member of Shaanxi Staff Innovation Studio, Embedded Technology Committee of Shaanxi Computer Society, and Space Science Research Center of NPU. Dr. Zhigang's research filed is technology and application of microsatellite, precision guidance and control of flight vehicles, high performance electrical servo system etc. He has won 2 Awards of National Defence Science and Technology Progress, along with 3 achievements' appraisal of National Defence Scientific. Nearly 30 national research projects have been hosted or undertaken by him in recent years, 28 academic papers have been published, including 12 papers indexed by SCI/EI, and 14 invention patents have been declared. He has worked on the development of microsatellites series of "Ao-Xiang".

Abstract:

Aiming at the problem of insufficient energy supply of solar panels to CubeSat payload, a method based on the modular energy unit with sun pointing solar wings is proposed. Four 2-DoF solar wings are contained in 1U space, which trace the orientation of sun independently, realize the effective incidence of sunlight and achieve the most productivity of solar photovoltaic. Meanwhile, by combining the modular energy units and adjusting the number of solar wings

properly, the array of multi solar panels is formed, applying on the CubeSat with different configurations.

The productivity of solar photovoltaic using this method is 2.6 times as the one of stationary solar wing with identical area, and the operation requirements of overall processes containing launching, deploying and on-orbit working can be met by employing the expandable structure. Moreover, the dual channel servo system based on the feedback of measuring result on solar vector is obtained, realizing the angle tracking of sunlight in a wide range. The energy management system proposed in this paper can achieve the generation, storage, adjustment and management of photovoltaic energy, and transfer the electrical energy and signal among multi modules, which supplies higher payload power and more redundant capacity against the fault of solar panels. Therefore, the proposed modular energy unit with solar panels can satisfy the performance requirements of higher output power and reliable work ability of CubeSat energy system.

Dr. Huiqing Fan

Professor

Northwestern Polytechnical University, China

KEYNOTE: Electrochemical Energy Storage Performance of Cobalt based Nanomaterials

Profile:

Prof. Huiqing completed his Ph.D. in Electronic Material Science (1998), MS in Electronic Engineering (1995), and B.S. in Physics (1992) from Xi'an Jiaotong University. Since 2003, he is a professor at Material Science and Engineering department for Northwestern Polytechnical Univeristy, Xi'an, China, and is serving as an editor for Journal of Alloys and Compounds, and Scientific Reports. Prof. Fan is interested in the ceramic processing, chemical synthesis and crystal growth of new and improved oxide ferroelectric materials for dielectric and piezoelectric applications. With further emphasis on the structure-property relationships for ferroelectric, piezoelectric, pyroelectric and photo-electronic ceramics in polycrystalline and single crystal form, including nanocrystalline materials and thin-layer devices. The overall goal is to develop better materials and methods for the preparation of advanced electrical ceramics and integrated devices. He published 4 books, over 500 authored / co-authored peer reviewed SCI papers and also holds 32 Chinese patents. So far, 38 Ph. D. students and 78 MS students got their degrees under his supervision in his Electronic Informational Materials group at Northwestern Polytechnical University.

Abstract:

As electrochemical energy storage devices show an increasing demand for high safety, low cost, easy production and high energy density, aqueous supercapacitors have become one of the great trends for researcher and industry. The aqueous supercapacitors are composed of positive and negative electrodes, electrolyte and separator. Supercapacitors store electrical energy through rapid oxidation-reduction reactions at/near the electrode-electrolyte interface

or high-speed reversible interfacial adsorption/desorption. Therefore, supercapacitors show the advantages of fast charging and discharging, a long cycle life, and a high power density. In this work, 3D heterostructure CoWO4/Co3O4 nanocone arrays (NCAs) were synthesized via a facile and efficient microwave hydrothermal method and their electrochemical energy storage performance were investigated systematically. The obtained CoWO4/Co3O4 NCAs exhibit four pairs of redox peaks in cyclic voltammetry curves, indicating that more charges can be stored during charging/discharging. The NCAs also overcome the shortcomings of low conductivity to achieve higher electrochemical performance. The assembled hybrid supercapacitors exhibit high energy density of 57.8 Wh kg-1 even at a high total loading mass of 23.1 mg of active materials as shown in figure 1. At the same time, CoWO4 has a protective effect on Co3O4, avoiding direct contact between Co3O4 and electrolyte to reduce the volume expansion of the composite material, so the cycle stability has been greatly improved. As observed from the cycle test, the decomposition of the active materials induces reduction in energy density and cyclic stability. Therefore, a new strategy of pre-adding Co2+ to achieve the dissolution equilibrium of cobalt in active materials is proposed, which can improve the cyclic lifetime of electrode materials and broaden the operation window of electrochemical devices. A large amount of quantum dots and second-order flaky CoO layers were formed in-situ in the electrochemical reaction process. Co2+ and Li+ embedded in carbon electrode during charging can enhance H+ desorption energy barrier, further hampering the critical step of bulk water electrolysis. More importantly, the highly reversible chemical conversion mechanism between Co3O4 and protons is demonstrated in neutral solution. The as-assembled device achieves a high operation voltage of 2.2 V, excellent cycling stability as capacitance retention of 168 % after 10000 cycles, and ultrahigh energy density of 99 W h kg-1 at a power density of 1100 W kg-1.

Dr. Filippo Neri

President

VirtuaLabs, Italy

KEYNOTE: Space: A Domain for Big Challenges

Profile:

Dr. Filippo Neri received his Ph.D. in electronics engineering at Rome University, Italy. He began working in the second part of 1960 with Selenia SPA (now Leonardo), where he became the head of the Tracking Radar Department. Dr. Neri managed the development of many new radars based on advanced technologies and techniques, including the monopulse tracking system, coherent chain TX-RX, and frequency agility. In 1981 he was transferred to the electronic warfare (EW) division as EW systems manager. In 1985, Dr. Neri moved to Elettronica SPA in Rome, first as Director of Research and new Products and later as Technical Director, a position in which he promoted the development of the most advanced EW technologies and techniques. In particular, he contributed significantly to the implementation of the solid-state active antenna technology, presently applied both to airborne and naval ECM systems and of the Cross-Eye jamming technique implementation. In 1998-1999, Dr. Neri was the Chairman of the WEAG (Western Europe Armament Group) Study Group for EW and Direct Energy Weapons (DEW). At the end of this work, he received the "Euclid" prize.

Dr. Neri holds many international patents relating to inventions in both the Radar and EW fields. Presently, he is the president of Virtualabs SRL, a company fully dedicated to the Radar and EW Systems innovation where very advanced radar and EW systems are realized.

Dr. Neri received many awards and recognitions for the work so far done both in Italy (e.g. "Maestro del Lavoro" from Italian President hon. Carlo Azeglio Ciampi and "Commendatore" from Italian President hon. Giorgio Napolitano) and abroad (e.g. "Distinguished Fellowship Award" of Defense Science Organization (DSO) of Singapore and induction in the AOC Electronic Warfare Technology Hall of Fame of USA).

Abstract:

After considering the fast evolution of Space Activities and relevant demanding technologies and procedures, the presentation highlights how defense systems are spreading in the Space domain. All these activities are causing an annoying space environment pollution that must be controlled. After considering few examples of the sword-shield war gaming in space, the generation of new good ideas is stimulated.

Dr. Renato Filjar

Professor

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KEYNOTE: A Contribution to Short-Term Rapidly Developing Geomagnetic Storm Classification for GNSS Ionospheric Effects Mitigation Model Development

Profile:

Renato Filjar is a Honorary Professor of Electronics Engineering atFaculty of Engineering University of Rijeka, Croatia, and aProfessor and Vice-dean for science and international relations atKrapina University of Applied Sciences, Croatia. He holds BSc (1987), MSc (1994) and PhD (2007) degrees inelectrical engineering, respectively, from Faculty of ElectricalEngineering and Computing, University of Zagreb, Croatia.His professional interests include: GNSS resilience developmentagainst adverse space weather, geomagnetic, ionospheric, multipath,and spoofing effects; statistical, mathematical and computer scienceframework for the adaptive environment-aware GNSS positionestimation; statistical learning and predictive modelling; spatial andsensor information fusion; application-scaled GNSS positioningperformance; GNSS Software-Defined Radio, and nature-inspirednavigation methods. Dr Filjar is involved in international science, research, development,commercialisation and education activities and initiatives related tosatellite navigation, through his expert co-operation with the UNInternational Committee on GNSS (ICG), International SpaceWeather Initiative (ISWI), the European Union Agency for SpaceProgrammes (EUSPA, former GSA), European TelecommunicationsStandardisation Institute (ETSI), and universities accross the world.He authored one book, with his associate Ms Mia Filić, and authoredor co-authored 26 scientific manuscripts published in internationalscientific journals (most of themindexed in the scientific data basesCurrent Contents, Clarivate Analytics Web of Sciences CoreCollection, IEEE Xplore, and/or Scopus), and more than 110conference papers. He is the leading holder of one consensual patent.Dr Filjar is a Fellow of The Royal Institute of Navigation (RIN),London, UK, a Member of the Institute of Navigation (ION), and aMember of the International Society of Information Fusion (ISIF).Dr Renato Filjar was presented with the RIN J E D Williams (Silver)

Medal (Royal Institute of Navigation, London, UK) in 2010. He waselected a Honorary Fellow of the International TransNav Conference (Maritime University of Gdynia, Gdynia, Poland) in 2021. He established and organised the traditional Baška GNSSconference, held annually in Baška, Krk Island, Croatia

Abstract:

The Global Navigation Satellite System (GNSS) resilience against adverse space weather effects has become the major research topic, as satellite navigation evolves to an essential component of national infrastructure, and the enabling technology of a growing number of technology and socio-economic applications (systems and services). Ionospheric effects have been identified as the prime single cause of the GNSS positioning performance degradation, thus placing mitigation of the ionospheric effects on the GNSS positioning performance into focus of research worldwide. Classification of scenarios of ionospheric disturbances provides an essential framework for development of the GNSS ionospheric effects prediction model. Conventional approach involves experimental and atmospheric-physics-based classification approaches, which frequently fail in reflection to the GNSS positioning performance sustainability. Here the results of the analysis of the GPS pseudoranges-derived Total Electron Content (TEC) times series, taken in selected recent cases of the short-term and rapidly developing geomagnetic storms, are presented. Particular scenarios are selected for their impact on GNSS positioning performance, theirnature, and the risk of not being taken into account by existing generalised global models for GNSS ionospheric effects correction. The research identifies similarities and diversities in time series characterization. As the inference and conclusion, a set of the time series characterization indices is proposed as the classification elements for the purpose of the scenario identification, and development and application of the most suitable experimental statistical learning GNSS ionospheric effects prediction models. The proposed classification approach may replace the conventional classification methods, such as NOAA Space Weather Scales, allowing for development of adaptive,and more accurate and direct GNSS ionospheric effects prediction models.

Dr. Dinesh Manandhar

Associate Professor

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KEYNOTE: GNSS Opportunities and Challenges

Profile:

Dr. Manandhar is currently working on GNSS signal authentication. He is involved in signal authentication system development for QZSS. He is also working on developing low-cost GNSS receiver systems for high-accuracy based on RTK and MADOCA-PPP. He conducts several GNSS capacity building activities by conducting seminars, webinars, trainings and pilot projects in collaboration with other universities and UNOOSA/ICG in various countries basically in Asia. He is one of the signal designers for indoor navigation system called IMES. He is one of the members of ICAO/NSP for DFMC SBAS signal authentication. He did his Ph.D. from The University of Tokyo in 2001.

Abstract:

GNSS service is provided by six systems (GPS, GLONASS, GALILEO, BEIDOU, QZSS and NAVIC) from six countries. These days we can see more than 40 navigation satellites and they can provide an accuracy better than 10m in standard operation mode. Smart-phones have GNSS for location services. GNSS has become mandatory in many countries for various types of safety and security related services and applications. In the next few years, we will see more systems and satellites. Although, several systems and so many satellites have been deployed in the past decade, there have been little progress in capacity development both at field working level and policy level to utilize the services available from GNSS technology basically in Asian and African countries. In order to best utilize the opportunities from these systems, it is necessary to generate required manpower at various levels, educate policy and decision makers as well as stake-holders. Once GNSS is widely used in several applications, it is also necessary

to take measures against issues like interference, jamming and spoofing. These are some of the challenges that the service providers and users might be facing once GNSS is fully deployed in a system. In this talk, we will discuss about how GNSS can be used for various applications, what shall be developed to integrate the technology in a system and what type of challenges might emerge in future such as signal spoofing.

Dr. Xiaoliang Wang

Associate Research Fellow

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KEYNOTE: Multifunctional Microsatellite Radio Occultation Observation Receiver Using BeiDou III B1C/B2a signals——a BRAIA Supported Project

Profile:

Xiaoliang Wang is currently with the School of Aeronautics and Astronautics as an Associate Research Fellow in Shanghai Jiao Tong University, China. He received his B.S. and M.S. degrees in system control engineering from Northwestern Polytechnic University in 2003 & 2006, Xi'an, China, and received a Ph.D degree majoring in navigation, guidance and control in School of Aeronautics and Astronautics from Shanghai Jiaotong University, Shanghai, China, in 2011. From 2011 to 2017 he worked as a Senior Engineer with Institute of Satellite Navigation and Intra-Satellite-Link Technology, Academy of Space Electronic Information Technology, Xi'an, China. He is a recognized expert in the field of GNSS applications in space and is a principle leader of High Sensitive GNSS Receiver (HiSGR) project with many published articles during this period. His research interests include design and evaluation of space borne GNSS receiver for multiple missions, weak GNSS signal acquisition & tracking, ultra-tight coupled GNSS/Inertial technology in space, autonomous real-time orbit determination on-board, nonlinear Kalman Filter technology, and nonlinear estimation and control of time-delayed systems.

Abstract:

In this talk, the authors would like to introduce a joint research project named "Multifunctional microsatellite radio occultation observation receiver using BeiDou III B1C/B2a signals", funded by Belt & Road Aerospace Innovation Alliance (BRAIA), among NPU(China)/SJTU(China)/IST(Pakistan). The project will conduct in-depth research on real spaceborne RO receiver using BeiDou III B1C/B2a signals, especially suitable for microsatellite platform. The receiver

operates on primary mode for global ionospheric electron density (Ne) modelling, and capable of offering multiple applications in future. The research including principle design and develop of receiver hardware, atmosphere observation modelling and process algorithm. This talk will give an overview of project executive information of this project, including prototype receiver design process and current development stage.

Dr. Eng. Ariel C. Blanco

Director

Philippines Space Agency, Philippines

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KEYNOTE: Environmental Application of Remote Sensing: Examples from the Philippines

Profile:

Dr. Ariel C. Blanco is a Professor of Geodetic Engineering at the University of the Philippines (UP) Diliman. He is on secondment to the Philippine Space Agency (PhilSA) as Director of the Space Information Infrastructure Bureau (SIIB). The SIIB is in charge of the vital infrastructure that focus on the generation, computation, processing, archiving, and distribution of space-borne data and information through ground segment and downstream facilities, including multi-mission ground stations for satellites and other space missions, high-performance computing facilities, data archiving and cataloging systems, computational tools, and associated information technology systems that serve as the underlying infrastructure for that transformation of data into useful information.

He is also the founding head of the Environmental Systems Applications of Geomatics Engineering (EnviSAGE) Research and Development Laboratory of the UP Department of Geodetic Engineering. Through this lab and the UP Training Center for Applied Geodesy and Photogrammetry, Dr. Blanco successfully led and completed various R&D projects utilizing geospatial technologies in various environmental application. He is currently the Program Leader of the DOST-funded IM4ManilaBay Program, the Integrated Mapping, Monitoring, Modelling, and Management System for Manila Bay and Linked Environments Program. He is in charge of the component Project MapABLE, Development of Integrated Mapping, Monitoring, and Analytical Network System for Manila Bay and Linked Environments. Dr. Blanco is also the Project Director and Leader of the Japan International Cooperation Agency (JICA) and UPD-funded project on blue carbon entitled "Comprehensive Assessment and Conservation of Blue Carbon Ecosystems and their Services in the Coral Triangle".

Abstract:

Environmental monitoring and assessment is one of the major applications of remote sensing. Space data can be used in a number of ways to examine the spatio-temporal distributions of environmental parameters. Images are used to assess changes that are or have occurred in the environment, be it in land, water, or air. In this presentation, example environmental applications of remote sensing will be discussed. These includes studies on land use land cover LULC, blue carbon ecosystems, and water quality. Machine learning has been used in generating accurate LULC layers. For blue carbon ecosystem assessments, development and progress in nationwide mapping will be presented. On water quality and related topics, examples are from the projects on Laguna Lake and Manila Bay. In addition to describing the needs, methodologies, and results from various studies, the status, challenges, and opportunities related to widespread utilization and operationalization will be discussed.

Dr. Salman Ashraf

Remote Sensing Scientist

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KEYNOTE: Assessing slope failures in Wellington city – the story of 80 years of geospatial data processing and analysis.

Profile:

Dr Salman Ashraf is Remote Sensing Scientist at the Institute of Geological and Nuclear Sciences Limited (GNS Science), New Zealand's leading Crown Research Institute of Earth, geoscience and isotope research. He received his M.Sc. degree in Space Science from University of the Punjab, Lahore, Pakistan and Ph.D. degree in Biological Science from the University of Waikato, Hamilton, N.Z. He worked in the past with World Wide Fund for Nature (WWF-Pakistan), National Avian Research Centre (NARC), Abu Dhabi, UAE and International Water Management Institute (IWMI-Pakistan). His broad area of interest lies in processing optical remote sensing, hyperspectral and thermal images to understand natural Earth system processes and resources, and to analyse these into economic, environmental and social benefits.

Abstract:

Many hundreds of slope failures affect Wellington's roading network each year and most of these failures occur on slopes that have been modified by urban development. The Stability of Land in Dynamic Environments (SLIDE) project aims to assess the performance of natural and anthropogenic slopes in central Wellington city under earthquake shaking and significant rain events or a combination of both. The project has used historical stereo APs (aerial photos) of 1938 and 1945 and contemporary LiDAR sensors to generate digital elevation models of then and now. These datasets helped to differentiate between natural and anthropogenic slopes. These latter slopes are those which have been modified by cutting or filling, typically referred to as earthworks. The research project aims to find research questions about how cuts and fills perform during strong earthquake shaking and how material properties and slope geometry influence cut/fill slope performance.

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

National Keynote Speakers

Institute of Space Technology

Dr. Adnan Maqsood

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KEYNOTE: Stability & Control Investigations for Versatile Aerospace Problems through CFD

Profile:

Dr. Adnan Maqsood is an Associate Professor and Director Academics at National University of Sciences and Technology (NUST), Pakistan. He received his Bachelor's degree in Aerospace Engineering from NUST, Pakistan, in 2005 and Ph.D. from Nanyang Technological University (NTU), Singapore, in 2012.

In addition to serving as Director Academics of NUST, Dr. Adnan is responsible for graduate teaching and research and is also heading Computational Aeronautics Lab at NUST. Dr. Adnan has an extensive teaching experience as well as substantial research experience. He has worked as Research Fellow and Project Officer at Nanyang Technological University, Singapore.

At NUST, he has effectively managed and participated as a principal and co-principal investigator in 15 different research projects funded by Higher Education Commission (HEC), Pakistan Air Force (PAF), Pakistan Aeronautical Complex (PAC), Pakistan Ordnance Factories (POF), and Belt & Road Aerospace Innovation Alliance (BRAIA) Seed Fund, China with total funding grant of more than 23 million PKR. He has authored 68 scientific publications. In his academic and professional career, he has several noteworthy awards and medals under his belt.

Abstract:

Flight stability and control concerns with the measure / prediction of aerodynamic forces and moments in response to a change in flight state of an aircraft. Predicting stability and control characteristics with traditional methods such as wind-tunnel testing is expensive and

difficult. The empirical methods are although fast and affordable but suffer from accuracy losses, especially in nonlinear regions. Computational Fluid Dynamics (CFD) has emerged as an alternative methodology in predicting the aerodynamic and flight stability characteristics for different flying configurations. As aircraft designs continue to evolve towards highly-maneuverable systems, accurate aerodynamic & flight stability databases are required. CFD can help in accurately predicting flight behavior and develop stability and control laws for Aircraft Flight Control development as well as high-fidelity flight simulators. In this talk, a capacity-building exercise, performed by the Computational Aeronautics Lab of the National University of Sciences & Technology will be discussed. Dynamic stability evaluations were carried out across the broad spectrum of Mach number. These investigations start from stability characteristics of corrugated airfoil wings, and low-aspect-ratio wings for Micro Air Vehicles, to advanced fighter aircraft, supersonic projectiles, and atmospheric entry vehicles. Special emphasis is given to the numerical and analytical modeling of limiting cases, i.e., the emergence of limit cycle oscillations due to loss in damping. Analytical solutions are also developed for the limiting cases through the Multiple Time Scales method, which belongs to the class of perturbation techniques. Extensive investigations related to wing-rock motion manifested at high angles of attack are discussed in detail.

Dr. Ali Sarosh

Associate Professor

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KEYNOTE: Application of Computational Intelligence Techniques for Sub-Orbital Vehicle Design

Profile:

Dr. Ali Sarosh is an aerospace engineer with more than 25 years of experience in industry, research, and academia. He holds a PhD degree in space vehicle design and MS degree is space propulsion. He is an approved PhD supervisor and founding director of Space Systems Research Labs (SSRL) at CAE (NUST). He has multiple research papers in reputed SCI and ISI indexed journals, international conferences and is member board of editors and reviewers of several international journals. He has previously served as head of department at NUST and is presently the cluster head of astronautics and propulsion research as well as aerothermal groups at Institute of Avionics and Aeronautics of Air University Islamabad. His research interests include design of future space transportation systems, spacecraft system design, scramjet propulsion system design and computational intelligence application in astronautics.

Abstract:

Sub-orbital vehicles (SOVs) include a wide array of space flight systems such as experimental launchers, orbital test vehicles, long range and medium range missiles etc. These systems are often constrained by cost limitations primarily owing to their limited role or expendability. One major approach to cutting down the development cost is to reduce the design cost and time of the SOVs. In this research the concept of applying computational intelligence (CI) techniques as tools for the SOV design is discussed. The underlying idea is to develop a fast and frugal method for predicting large-system design parameters of sub-orbital vehicles without having to go through the rigors of an iterative design process. The CI-based design tools are essentially expert systems that emulate the decision-making behaviour of a human expert. The objective

of the computational design tool is to predict predefined sizing and performance parameters using simple-as-possible (SAP) inputs. Two design algorithms are discussed within the ambit of a Carrier Vehicle Expert System (CVEX) program. The first of the design algorithms called N2SM is based on Artificial Neural Network (ANN). It is used for design parametrization of large SOVs such as ballistic exo-atmospheric vehicles. In the N2SM algorithm mapping of design inputs to parametric outputs is done through a multi-layered feed forward ANN with customized weights and biases. This formulation is based upon Nguyen–Widrow Initialization (NWI) function for the numerical prediction of design parameters and Levenberg Marquardt algorithm (LMA) with back propagation for network training function so as to minimize Mean Squared Errors (MSEs) and hence avoid local minima entrapment of error gradient. The second design algorithm is the ATMM. It is best suited for design parametrization of endo-atmospheric, short range ballistic systems. The ATMM scheme uses data mining technique of Adaptive Neuro-Fuzzy Inference System (ANFIS) based on Sugeno algorithm. The parametric results obtained for exo- and endo-atmospheric classes of SOVs using N2SM and ATMM algorithms respectively exhibit high-degree of conformance with legacy data of known SOVs while substantially reducing the efforts required for evolving a new baseline configuration.

Dr. Ali Javed Hashmi

Assistant Professor

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KEYNOTE: Laser Communications for Next Generation SATCOM

Profile:

Dr. Ali Javed Hashmi has been serving as Associate Professor at Air University, Islamabad, since 2015. He received his BS degree in Electrical Engineering from National University of Sciences and Technology, Islamabad. After Bachelors, he completed MS. and PhD degree in Electrical Engineering from Georgia Institute of Technology in 2006 and 2010, respectively.

His PhD research was sponsored by Jet Propulsion Laboratory (NASA). His research focused on analysis and design of novel architectures for future broadband architectures for deep-space communication. Dr Hashmi has worked on the design of an optical array receiver for deep-space optical communication link between Earth and Mars.

His research resulted in several conference and journal papers of international repute. Dr. Hashmi has authored/ co-authored 6 journal papers and 15 Conference papers. He has presented at conferences related to aerospace industry, communications, and optics fields. Owing to his extensive research experience, he has won several research awards at Georgia Institute of Technology including the best "Graduate Student Research" award in year 2008. He is also member of IEE and Royal Aeronautical Society, England.

Abstract:

The human quest to use medium of space for emerging, such as, data warehousing, relay stations, avenues for un-imaginable scientific discoveries, military high-ground vintage point, tourism, leisure travel, and future habitat continue to evolve with every passing day. Nevertheless,

high-speed communication systems are the backbone of all of these futuristic space missions, i.e., scientific discovery, commercial, and military ventures. The ever-increasing capability of onboard satellite payloads and sensors dictate equally progressing communication technologies. Near-space missions would demand communication architectures that are not only power-efficient but could facilitate data rates in 100s of Gbps regime. Similarly, demand for broadband technologies is more profound for deep-space ventures because of the huge distances (hundreds of millions kilometers) involved. For instance, National Aeronautics and Space Administration (NASA), European Space Agency (ESA), and Japanese Aerospace Exploration Agency (JAXA) continue to send discovery missions into deep-space. Other global players, such as China and India are also pursuing Lunar and Martian exploration programs, along with many commercial global enterprises. Free Space Optical (FSO) Communication technology show promising prospects to fulfill the broadband communication requirements of the current and futuristic space missions; including inter-satellite, near-space, and deep-space ventures. In this paper, an overview of current and futuristic FSO communication systems' architecture is presented. The strengths and challenges of FSO systems vis-à-vis RF systems are discussed along with the critical technology roadmap that would be required by FSO systems to fully cope-up with the futuristic communication challenges. In this regard, the selected ventures being pursued by international space agencies in FSO domain are delineated. Next, design, simulation, and analysis of a FSO link between Earth and Mars is presented that include modeling of the received signal and background photons, simulation of the communication system, and optimization of various important system parameters. It is shown that the performance of FSO receivers is far superior to the current radio frequency (RF) technology in terms of the achievable throughput for Earth-Mars link. In the end, a predicted roadmap for the FSO systems evolution in future is also discussed. It is concluded that FSO technology is the next generation communication technology that shows promising prospects to fulfill the bandwidth needs of future space missions.

Dr. Muhammad Kamran Saleem

Associate Professor

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KEYNOTE: The Floating Satellite System as an Educational Platform for Space Applications

Profile:

Dr. Muhammad Kamran Saleem is working as an Associate Professor (Faculty of Engineering) at the University of Central Punjab. After acquiring B.Sc. degree in Electrical Engineering from Mirpur University of Science and Technology, Pakistan, he completed M.Sc. Electrical Engineering from Blekinge Institute of Technology, Sweden. He received his Ph.D. degree in Communication Engineering from King Saud University (KSU), Saudi Arabia, in 2016.

Dr. Kamran has extensive research and teaching experience in his professional career. He started his professional journey by serving World Call (Wireless Local Loop) in 2005. He has demonstrated his excellent research skills through his performance in various research projects. Dr. Kamran has served in ZARM Center of Applied Space Technology and Microgravity, Germany in 2006, where he worked on a project funded by European Space Agency (ESA) with focus on satellite formation flying missions. He has also worked on research project: Microwave Waveguide Components for Satellite Payloads during his tenure at Space & Upper Atmosphere Research Commission of Pakistan (SUPARCO), Owing to his performance, he has been honoured with several awards for this research skills; including Research Excellence Award at King Saud University, Saudi Arabia.

Dr. Kamran has presented his research in form of various international journals, book chapters and conferences. He has 13 international journal publications, 02 international conference publications and has received 06 research grants for different projects in his career. Dr. Kamran is also member of editorial board of various international journals and conferences.

Abstract:

The Chair of Aerospace Information Technology at the University of Wurzburg, Germany has developed a Floating Satellite (FloatSat) system. This system is utilized by students as well as researchers/professionals to get familiar with basic satellite subsystems. Furthermore, this advanced system is also used to develop and test different attitude control algorithms and strategies for small satellites in an almost frictionless environment similar to that in space. The FloatSat system mainly consists of a mechanical structure that contains the basic satellite subsystems. This structure is placed into a hemisphere shell that is floating inside a spherical air-bearing unit. The air bearing unit requires compressed air input. To monitor and command the FloatSat, a ground station computer is used to communicate via Bluetooth or the Wi-Fi module available in the satellite through the commanding and telemetry display tool. Through the FloatSat system, various space missions can be designed such as

- Star tracking
- Satellite docking
- Sun tracking
- TM/TC
- Remote sensing
- Satellite solar panel deployment

Furthermore, the presented FloatSat system can be utilized very efficiently by engineering students in various domains such as electrical, mechanical, aerospace, avionics, controls to develop a very good understanding of Real-time Onboard Dependable Operating System (RODOS).

Dr. Nosherwan Shoaib

Associate Professor

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KEYNOTE: RF Energy Harvesting for Internet of Things (IoT) Applications

Profile:

Dr. Nosherwan Shoaib is working as Associate Professor at Research Institute for Microwave and Millimetre- Wave Studies (RIMMS), National University of Sciences and Technology (NUST), H-12, Islamabad, Pakistan. He received the double master's degree in electronics engineering and PhD degree in RF & microwave measurement engineering from the Politecnico di Torino, Italy. During his PhD studies, he participated as a researcher in European Metrology Research Programme (EMRP) Project SIB62 Metrology for New Electrical Measurement Quantities in High-frequency Circuits. He joined Research Institute for Microwave and Millimeter-Wave Studies (RIMMS) at School of Electrical Engineering and Computer Sciences (SEECS), National University of Sciences and Technology (NUST), Islamabad in Sept 2016.

Dr. Shoaib contributed to three patents, one book, one book chapter and more than 70 leading international technical journal, peer reviewed conference papers and technical reports. He is the recipient of Higher Education Commission (HEC) Start-Up Research Grant Program (SRGP). His research proposals worth above 25+ Million PKR are approved as Principal Investigator (PI) under HEC National Research Program for Universities (NRPU) and Technology Development Fund (TDF) funding scheme.

Dr. Shoaib is the senior member of IEEE and the founder & chair of Pakistan's first ever IEEE joint Microwave Theory & Techniques, Antenna & Propagation, Electromagnetic Compatibility/ Interference and Circuits & Systems (MTT-AP-EMC-CAS) chapter. Owing to his professional excellence, he has been awarded several national and international awards including Outstanding APS Chapter Award 2019, EMC Chapter of the Year Award 2019, Outstanding

IEEE MTT Chapter Award 2018 (as chapter chair), IEEE Electromagnetic Compatibility (EMC) Chapter Founder Award 2019 and Best Ph.D. Graduate Award 2015.

Abstract:

The RF energy harvesting is a "Green" self-sustainable operation which can potentially provide unlimited energy supply that can be used to remotely power up low power devices. In particular, it helps to eliminate the need for a battery, which not only increases the cost, weight, and size of the device but the battery replacement is also costly and time-consuming especially when a lot of devices are spread over wide or inaccessible areas. Furthermore, it improves the reliability, portability, and user and environment friendliness and reduces the size and cost of the device. In addition, the finite lifetime of the electrical batteries is encouraging the researchers to explore further solutions in the field of RF energy harvesting, as acknowledged by Nikola Tesla, who described the freedom to transfer energy between two points without the need for a physical connection to a power source as an "all-surpassing importance to man".

This talk will present an introduction to wireless power transfer (WPT) followed by a comparison between ambient energy sources and an overview of different components of rectennas that are used for RF energy harvesting. Being less costly and environment friendly, rectennas are used to provide potentially inexhaustible energy for powering up low IoT power sensors and portable devices that are installed in inaccessible areas where frequent battery replacement is difficult, if not impossible. The talk will also describe various stages of rectenna system including multiband/broadband antenna, matching network and rectifier. The current challenges in rectenna design & development and output power limitations will also be presented.

Dr. Syed Ali Hassan

Associate Professor

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KEYNOTE: The 6G Wireless Networks: What to Expect and How to Excel

Profile:

Dr. Syed Ali Hassan is an Associate Professor at School of Electrical Engineering and Computer Science (SEECS), NUST, Pakistan. He received his B.Sc. degree (Electrical Engineering) from National University of Sciences and Technology (NUST), Pakistan, M.Sc. degree (Electrical Engineering) from University of Stuttgart, Germany, M.Sc. (Mathematics) from Georgia Institute of Technology, USA and PhD (Electrical Engineering) from Georgia Institute of Technology, USA.
Dr. Ali Hassan has an extraordinary research and teaching experience of more than 15 years. During his professional career, he has worked as a Design Engineer, Researcher and a Professor. Owing to his excellent research skills, he has been honoured with several awards, including Best Researcher Award at SEECS- NUST, Research Productivity Award from Ministry of Science and Technology, Pakistan and Super Star Researcher Award at SEECS-NUST.

Dr. Ali Hassan has authored/co-authored more than 250 publications in international conferences, journals and books, and has organized several special issues/sessions as editor/chair in leading journals/conferences. He is also the CTO of Adept Tech Solutions, a US-based start-up having its R&D office in Pakistan, providing efficient solutions to engineering businesses.

Abstract:

The demand for wireless capacity is continuously growing with the advent of the Internet-of-Everything system, connecting millions of people and billions of machines. To date, the fifth

generation (5G) wireless networks are being rolled out in the world, providing a new vision to mobile communication. While 5G is still in its commercialization phase, the research on Beyond 5G (B5G) and sixth generation (6G) communication has already started ground work on innovative technologies that support the capacity growth of future networks with lower cost, energy consumption, and hardware complexity. In order to meet the stringent demands on spectral and energy efficiency, B5G and 6G will rely on new and advanced technologies ranging from cell-free massive MIMO, Terahertz band communication, pervasive artificial intelligence, ambient backscatter communications, to smart radio environments. In this talk, we discuss the basic concept of these technologies, covering the "what to expect" part, and then overview the research challenges that are seen to address their inception, the "How to excel" part.

Dr. M. Uzair Khan

Associate Professor

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KEYNOTE: Software Reliability Requirements for Mission and Safety Critical Systems

Profile:

Dr. Muhammad Uzair Khan is Associate Professor and the Director ORIC at National University of Computer and Emerging Sciences (NUCES). He received his PhD degree from University of Nice, Sophia Antipolis, France for the research work carried out at institut national de la recherche informatique et automatique (INRIA). He is the Head of Software Quality Engineering & Testing Lab, at NUCES-FAST Islamabad where he manages a team of 35+ research scientists, engineers and graduate students. He is also the head of a technical start-up that offers capacity building, software development and R&D services based on his extensive expertise and experience in Automated Software Testing, Quality Engineering of Mission and Safety Critical Systems, Development of Command-and-Control Software Systems, Avionics Software Systems, and Mapping and Survey and Mapping applications using autonomous drones. He is actively involved in projects of national significance with Pakistan Air force, Pakistan Aeronautical Complex and other public and private sector industry partners. He was the Principal Investigator of IGNITE funded project *Automated Generation and Testing of Mobile Application Variants (2017 - 2019)* and a Co-PI of UAS-Dependability Lab (2019 - 2021) which is part of National Center for Robotics and Automation. As the Director ORIC, he monitors and oversees all research and commercialization activities, industrial collaborations and linkages at 5 campuses of NUCES.

Abstract:

The talk shall focus on how to develop softwares for mission and safety critical systems. The softwares that are to be used in critical systems have strict requirements for complying with

various standards. A number of such standards exist covering domains such as satellite software systems, avionics software systems, health care systems, etc. All these standards place heavy emphasis on demonstrating the safety and reliability of software system through verification and validation activities. The talk will cover the issue of software reliability, the requirements of safety standards and the activities that need to be performed to develop software that can be certified for use in the critical systems.

Dr. Abdul Malik Khan

CEO & Director

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KEYNOTE: Pakistan's Geographical Position: Opportunities for Research in GNSS Domain

Profile:

Dr. Abdul Malik Khan, CEO of EmbedINN Pvt. Ltd has been involved in GNSS and related research & development for more than two decades. The research focus of his PhD studies is developing methods of GNSS spoofing detections using Principal Component Analysis, Slope metric and Distortion metrics, and also devising a method of synthetic spoofing data generation. During his BS from NED University, Karachi and MS from Georgia Institute of Technology (USA) in 2004 in Electrical & Computer Engineering, he covered research areas pertaining to Signal Processing that includes Data Mining, RVQ, Synthetic aperture radar and image processing. During the two decades of his professional career as an entrepreneur and also in a public sector organization, he developed several products which are being used by industry of both civil and defence sector. His latest work is the development of OctaNAV®, being the latest flagship product of his company, which can be used for the development of multi-antenna multi-frequency GNSS receiver applications.

Abstract:

The geographical position of Pakistan presents great opportunities for the research in GNSS domain. There are many factors favorable for the researcher in the field. One factor is the proximity to the equator which means availability to the maximum number of satellites. Also, Pakistan is at a point that has a high scintillation activity during the summer period. Also, the Pakistan is in the coverage of many geostationary satellites that includes SBAS satellites, and BieDou-I satellites. With respect to the earth tectonic plate activities, it is the country close to three tectonics plates, the Eurasian, Indian and Arabian plate. Also, it is one of the very few countries

that have fault lines on the land area. It also hosts the point where Himalia, Karakorum and Hindukush ranges meet. Out of 10 highest peaks, 8 peaks are within Pakistan. Also, the country hosts many glaciers within these ranges. The geo-political situation of Pakistan also makes it attractive for many GNSS research topics. It is also host of many type of migratory birds.
Due to these facts, Pakistan presents a lot of opportunities for the GNSS researchers and enthusiasts.

Dr. Arslan Ahmed

Associate Professor

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KEYNOTE: Multi-Constellation and Multi-Frequency GNSS Positioning using Environment Context Detection

Profile:

Dr. Arslan Ahmed is currently working as Chairperson and Associate Professor at the Department of Electrical Engineering, National Skills University Islamabad. He received his B.E. degree from Comsats Institute of Information Technology, Pakistan, M.Sc. degree in communication engineering from The University of Manchester, U.K., and Ph.D. degree in electrical engineering from Newcastle University, U.K.

He has extensive teaching experience having worked as Lecturer and Assistant Professor at Department of Electrical Engineering, Sukkur, IBA, Pakistan. He has also served in key administrative positions, such as Head Industrial Linkages and OBE Committee and Head of Accreditation at Sukkur IBA.

Dr. Arslan has 12 conference and 14 journal publications in GNSS related areas and has also given keynote talks at several international forums on GNSS. He also developed the first-ever GNSS and Space Weather Laboratory in Pakistan at Sukkur IBA with the help of government funding.

Abstract:

The changing environmental contexts in urban and suburban areas makes it hard for a GNSS receiver to give accurate and precise positioning and function properly without using any aiding devices. This talk gives a brief overview of the problems faced by a multi-frequency and multi-constellation GNSS receiver in urban and sub-urban areas having reduced visibility

and accuracy due to changing environmental context. The changing environmental context can further lead to unavailability of navigation services in city centers and congested areas. In order to improve the positioning accuracy for navigation receivers encountering varying environments, a context-aware adaptive navigation technique has been proposed to detect and characterize the environment in real-time and then initiate a mitigation strategy utilizing the redundancy of the range measurements to improve the positioning accuracy. The method uses the multi-constellation and multi-frequency GNSS receiver in quad-constellation mode, i. e., GPS, BeiDou, Galileo and GLONASS for environment detection and characterization by performing a series of experiments in the center of a city and the performance is compared with the single constellation GNSS receiver. An overall accuracy of 53% can be achieved employing the environment-aware context detection algorithm in low to highly degraded multipath/ NLOS areas which was only 32% using single constellation GNSS receivers.

Mr. Muhammad Ayyaz Ameen

General Manager

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KEYNOTE: Ionospheric Modelling

Profile:

Mr. Muhammad Ayyaz Ameen is performing his duties as General Manager at Pakistan Space & Upper Atmosphere Research Commission (SUPARCO). He has a Bachelors and two Masters Degrees in Physics. Mr. Ayaz Amin started his professional career as a lecturer at Hamdard College of Science & Commerce, Karachi. Soon after, he joined Pakistan Space & Upper Atmosphere Research Commission (SUPARCO) as Assistant Manager and climbed the ladder till General Manager. Mr. Ayaz Amin has several journal publications under his name as well as one published book titled 'A Study of Ionospheric F2-layer Frequency GPS Total Electron Content.

Abstract:

The Earth's ionosphere ranges from - 60 km - 1000 km in altitude. Since the time of its discovery in the beginning of the last century, numerous efforts have been made to understand and model the variations and morphology of ionosphere. The major modelling attempts include a quick electron density profiler, NeQuick and International Reference Ionosphere (IRI). Recently, the IRI community has updated the IRI-Extension to Plasmasphere (IRI-Plas 2020) to support the validation of global navigation satellite based (GNSS) total electron content (TEC) estimations. Regarding the ionospheric modelling activities in the country, ionospheric dynamics over the southernmost part of Pakistan are most interesting. This is due to the fact that it lies at the northern crest of equatorial ionization anomaly (EIA) region which is challenging in terms of modelling. During my invited talk I will discuss the ionospheric modelling attempts made in the country. These efforts include techniques from regression to the use of artificial neural network (ANN). The aim of modelling efforts is to enhance the understanding of ionospheric variations and improve related operational services.

Ms. Maria Zubair

GIS Specialist

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KEYNOTE: Land Suitability for Sugarcane in Punjab Province

Profile:

Ms. Maria Zubair is a team lead of Spatial Data Science Team in PITB, working as GIS Specialist. She completed her undergrad in Computer Science from Punjab University College of Information Technology, Lahore (PUCIT) and Masters in Computer Science from Lahore University of Management Sciences (LUMS). Ms. Maria has over 10 years of experience in the field of GIS and has worked on important projects like developing solutions for National Highway and Motorway Police (NHMP), E-Vaccs: a Vaccination Monitoring Initiative by Government of Punjab, Crop Monitoring and Yield estimation through Gardawari Datasets, Change Detection of Urban Construction and School Location Assessment using GIS, and many more. She also has teaching experience in her portfolio. Ms. Maria has also authored/co-authored several publications.

Abstract:

Covid Pandemic has highly affected socio-economic patterns all around the world. It has changed methods and structures in unexpected way. Pakistan, an agriculture-based country, has suffered losses as well. 64% of our country's population lives in rural parts and are directly or indirectly related to agriculture ecosystem. Agriculture which is the oldest means for food provision and support for social and domestic setup, has also seen a depression due to this pandemic. Along the above lines land suitability assessment for agriculture could revolutionize the food sector. Land suitability is a fundamental question faced by farmer each day. Farmer's major decisions are based on the heuristics he learns over time. Although concrete solutions like which crop is suitable, for which part of the land, they owned, can be addressed using

modern science and technology solutions. Land suitability assessment and crop classification could be a game changer for the above problems. Crop classification has been the most talked solution in the field of space technology, with the advent and access of new and improved data.

Punjab, the land of five rivers, is the most fertile and populous province with 60% of the country's population living, is our area of interest, with an area of 205,071 km2. Sugarcane was our primary interest crop. Land suitability has been calculated for the same area and crop. Our results showed that approximately 9% of the total area and 16% of the cultivated area is used for cultivating sugarcane. The land suitability results show that 61% area of cultivated land is suitable for sugarcane and 28% land is highly suitable which is more than where 58% of total area is cultivated land. Variables like temperature, precipitation, pH, soil organic carbon etc., are used for calculating suitability. Our analysis shows that precipitation alone is insufficient for sugarcane. Irrigation system is contributing towards crop yield, more canals are needed though for more and better sugarcane cultivation. The soil is loamy and pH is ideal for cultivating crops, even dessert surrounding area is suitable, provided, water is sufficient. Decisions like timely and adequate water provision for the sugarcane can be made using suitability analysis.

The suitability map aligns with classification map and there is room for more. Suitability could be a solution leading to planning crop sown to address crop shortage ahead of time. This could help policy makers in developing a crop calendar both spatially and temporally. Smart and effective budget allocation can be achieved on the basis of suitability analysis. Resource such as land, labor and capital are limited in relation to their demand. Suitability maps could help us in managing all three.

In this current era, we are both facing nightmares of the disease and defending ourselves, by preventing damage in economic structures and its after effects. Unemployment has been the highlight of many countries during this time period. Food security and availability is a social crisis after pandemic. Land suitability for crops could be a way out. Inclination of governments towards agriculture sector will not only encourage farmers to remain in the agriculture field it will also create employment opportunities for people related to food industry. Pakistan was once among the top 5 sugar producing countries now it has dropped to number 9. This might put our country on the map again as one of the sugar's biggest export countries.

Dr. Dostdar Hussain

Associate Professor

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KEYNOTE: A Machine Learning Approach for Hydrological Time-Series Prediction: A Case Study of Gilgit River Basin

Profile:

Dr. Dostar Hussain serving as Assistant Professor, Department of Computer Sciences at Karakoram International University, Pakistan. With two Masters Degrees in Information Technology and Computer Science, and a Doctorate of Philosophy in Geomatics Engineering, Dr. Dostar has an extensive research and teaching experience.

Dr. Dostar started his professional career as a lecturer at Directorate of Education, Gilgit-Pakistan. He has over 10 years of teaching experience. Dr. Dostar has also proven his expertise through several national and international research publications. He has authored/ co-authored up to 12 publications and has contributed on several key significant projects, including Baseline Assessment of Agriculture Water, Energy and Climate induced Hazards in the Upper Indus Basin of Pakistan, funded by WWF-Pakistan.

Abstract:

Streamflow prediction is a significant undertaking for water resources planning and management. Accurate forecasting of streamflow always being a challenging task for the hydrologist due to its high stochastic and dynamic patterns. Several traditional and the deep learning models have been applied to simulate the complex nature of the hydrological system. However, to develop and explore a better expert system for prediction is a continuous exertion for hydrological studies. In this study, a deep neural network, namely a one-dimensional convolution neural network (1D-CNN) and extreme learning machine (ELM) are explored for one-step-ahead streamflow forecasting for three-time horizons (daily, weekly and monthly)

in Gilgit River, Pakistan. The 1D-CNN model gained incredible popularity due to its state-of-the-art performance and nominal computational complexity; while ELM model performed superfast as compared to traditional/deep learning architecture, gives comparable performance with fast execution rate. A comparative analysis is presented to assess the performance of the 1D-CNN related to the ELM model. The performance measurement matrices defined as the correlation coefficient (R2), mean absolute error (MAE) and root mean square error (RMSE) computed between the observed and predicted streamflow to evaluate the 1D-CNN and ELM model efficacy. The results indicated that the ELM model performed relatively better than the 1D-CNN model based on predefined statistical measures in three-time scale. In numerical terms, the superiority of ELM over 1D-CNN model was demonstrated by R2 = 0.99, MAE = 18.8, RMSE = 50.14, and R2 = 0.97, MAE = 136.59, RMSE = 230.9, for daily streamflow (testing phase) respectively. Based on our findings, it can be concluded that the ELM model would be an alternative to the 1D-CNN model for highly accurate streamflow forecasting in mountainous regions of the world.

Dr. Waqas A. Qazi

Chief Technology Officer

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WORKSHOP: Synthetic Aperture Radar (SAR) for Earth Remote Sensing'

Profile:

Dr. Waqas A. Qazi is currently the CTO at Offshore Monitoring Ltd. He holds a Ph.D. from University of Colorado, Boulder, USA, under a Fulbright fellowship, and served for many years in the faculty of the Dept. of Space Science, Institute of Space Technology (IST), Islamabad, Pakistan, where he initiated the Radar Remote Sensing group and was one of the founders of the Geospatial Research & Education Lab (GREL). He has also spent a few months as a Visiting Researcher at Radar Remote Sensing Group, Division of Microwave & Optical Remote Sensing, Department of Space, Earth & Environment, Chalmers University of Technology, Gothenburg, Sweden.

He considers himself as an Earth Scientist or Remote Sensing Scientist, with specialized skills in SAR remote sensing, satellite oceanography, and strategic management of technical teams with diverse skill sets. His broader research interests in remote sensing can be summarized as: Synthetic Aperture Radar (SAR) imagery and interferometric data processing & analysis, visible/infrared / high-res satellite image processing & analysis, satellite oceanography, forest biomass, Earth system study and modeling, LIDAR data processing and analysis, and scientific programming. He is a reviewer for IEEE Transactions on Geoscience & Remote Sensing, IEEE Geoscience & Remote Sensing Letters, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, Remote Sensing, Forest Ecosystems, Forest Ecology & Management, GIScience & Remote Sensing, Journal of African Earth Sciences, Egyptian Journal of Remote Sensing & Space Sciences, Regional Studies in Marine Science, and Italian Journal of Agronomy. He is an alumnus of Pakistan National Physics Talent Contest (NPTC), an alumnus of the Lindau Nobel Laureate Meetings, and a Fulbright fellow. From 2013 – 2017, he has been the Pakistan National Point of Contact for Space Generation Advisory Council (SGAC). He

was an invited speaker at the TEDxIslamabad event held in Nov. 2014. He also served as a mentor in the NASA International Space Apps Challenge Islamabad events in April 2015 and 2016. He also serves regularly on interview panels for the final selection of Fulbright MS and Ph.D. candidates from Pakistan. He blogs at EarthEnable (http://earthenable.wordpress.com) on topics related to remote sensing, earth observation, scientific programming, and academic publishing.

Prof. Dr. M. Farooq Ahmed

Professor/Chairman

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KEYNOTE: Assessment of Renewable Energy Zones Across Pakistan Using GIS Based Multi-criterion Analysis

Profile:

Dr. Muhammad Farooq Ahmed is serving as Chairman, Department of Geological Engineering, University of Engineering and Technology Lahore, Pakistan. In his academic qualification, he obtained B.Sc. Geological Engineering and M.Sc. Civil Engineering from University of Engineering & Technology, Lahore. He also obtained M.Sc. Geological Engineering and PhD in Geological Engineering from Missouri University of Science & Technology, USA.

Dr. Farooq has a collective teaching experience of more than 13 years and has also worked as a researcher at the Department of Geosciences and Geological and Petroleum Engineering, Missouri University of Science and Technology, USA. In his professional career, Dr. Farooq has worked on several important projects including Disaster Management, GIS based Baluchistan Solar Pumping Project and Pakistan Renewable Energy Locational Study supported by World Bank.

He has also shared his knowledge through various insightful talks at different events. Dr. Farooq has authored/ co-authored 18 publications.

Dr. Farooq is HEC Approved Supervisor for PhD studies as well as Professional member of Association of Environmental and Engineering Geologist (AEG), Geological Society of America (GSA), American Rock Mechanics Association (ARMA) and American Society of Civil Engineers (ASCE).

Abstract:

The renewable energy sources have several advantages compared to conventional electricity generation systems due to their lower generation costs, independence from fossil fuels, and short installation times. Solar and wind power generation are effective and low-cost options to reduce the gap between demand and supply of electricity in all provinces of Pakistan.

The study aims to utilized the GIS based multicriteria analysis to identify the most suitable renewable energy zones for solar and wind power development in Pakistan. An adequate zoning analysis demands for various socioenvironmental and techno-economic data sets in both spatial and nonspatial formats as input data. The input data for the analysis was obtained from national and international resources. Wind and solar resource raster maps (wind speed distribution for wind power and solar irradiation for solar power of Pakistan) were obtained from the Global Wind Atlas (DTU 2019), and the Global Solar Atlas, respectively. The other input map layers include landuse/landcover, road network, slope, elevation, transmission lines, grids network, existing power plants, protected areas, population, and flood plains. First of all, the thresholds for the inclusion and exclusion criteria was applied to identify suitable zones within economic constraints, and technical and environmental feasibility (e.g., exclusion of flood-risk areas, exclusion of areas with settlements or crop cultivation).

The study uses the latest version of the MapRE tool developed by Lawrence Berkeley National Laboratory (LBNL) in the Geographic Information System (GIS) environment to identify potentially suitable zones. In order to allow for strategic planning of new solar and wind plants, countrywide maps have been developed based on solar and wind resources and other factors, both for the country as a whole and for the provinces individually. The multi-criteria analysis for Solar power potential in Pakistan was carried out based on the capacity factor resource raster data. The resultant maps reveal that conditions for solar power are pretty much favorable all over the country, especially in the southern areas of Baluchistan, Sindh, and southern Punjab. Northern areas have potential for solar power deployment at a cost which is comparatively higher, but still competitive on the international level.

The multi-criteria analysis for wind power potential in Pakistan was carried out based on the capacity factor resource raster data for IEC Class II wind power plants obtained from the Global Wind Atlas. Capacity factor values for wind across the whole of Pakistan range between 13 percent (lowest) and 60 percent (highest). Overall, there are some areas in Sindh and Baluchistan with considerably higher capacity factor values that are very favorable for wind power generation.

The resultant maps of this GIS-based analysis for solar and wind, showing the "financial attractiveness" of every possible location in all of the provinces of Pakistan. This study confirms that Pakistan has excellent resources for economically viable solar power and wind power generation, both of which are mostly untapped so far. This project also highlights the effective utilization of the GIS based multi-criterion analysis to perform this type of strategically important national level studies.

Dr. Nadia Imtiaz

Principal Scientist

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KEYNOTE: Multivariables Analysis to Assess Ionospheric Abnormalities associated with the outer space

Profile:

Dr. Nadia Imtiaz is serving as a Principal Scientist at Theoretical Physics Division, PINSTECH (PAEC), Pakistan. With a Bachelor's in Physics from Quaid-e-Azam University and Masters in Medical Physics from Pakistan Institute of Engineering and Applied Sciences, (PIEAS), Dr. Nadia completed her PhD in Numerical Study of Ionospheric Response to Perturbations and Interaction with Spacecraft Instruments from Space Plasma Physics, University of Alberta, Canada. Dr. Nadia has extensive research experience having worked as senior and junior scientist at Theoretical Plasma Physics Division and Health Physics Division, PINSTECH (PAEC), respectively. Owing to her professional expertise, Dr. Nadia has up to 22 publications in national and international journals. In her professional career, she has also bagged several awards including Best Presentation Awards and Travel Awards. Dr. Nadia is a member of American Geophysical Union and American Physical Society.

Abstract:

We carried out multivariables analysis to investigate the ionospheric disturbances associated with the space weather event. We present a case study of a strong geomagnetic storm of 25-26 August 2018 that results from the arrival of the coronal mass ejection on the Earth. For this purpose, we analyzed multi-instrument data, including the solar wind parameters, the GPS-TEC, the thermosphere neutral composition, and the magnetometers over the three consecutive longitudes, which are Asian, African, and American. The storm-time response of the electron density is assessed by the global, regional, and vertical total electron content obtained from the GPS receivers data. Both positive phases of the storm and negative ones are observed in the

three longitudinal sectors during the main phase until the late recovery phases of the storm. A significant increase in the electron density around the equatorial ionization anomaly crests is seen during the main phase of the storm. The storm-time disturbances of the thermosphere are characterized by the global O/N2maps provided by the Global Ultraviolet Spectrographic Imager onboard the satellite Thermosphere Ionosphere Mesosphere Energetics and Dynamics. The expected hemispheric asymmetry of the thermosphere can be associated with possible differences in heating and convection in the middle and lower latitudes. Moreover, the unprecedented behavior of the neutrals over the East-African and Asian longitudes can be attributed to the strong northward meridional wind circulations. Finally, the ground-based magnetometers data have been analyzed for storm-induced perturbations of the horizontal component of the Earth's magnetic field and the ionospheric electric currents. A large decrease in the horizontal component of the geomagnetic field over the local dayside sector (Asian) is associated with the enhanced ring current effect. The spectral analysis of the magnetic data indicates the existence of short-term and diurnal oscillations during the storm period. These oscillations are associated with the prompt penetration and the disturbance of dynamo-electric fields. It can be inferred that physical factors such as the ionospheric electrodynamics, the thermosphere neutral composition, and the neutral wind circulations play an important role in the observed storm-time response of the ionosphere.

Dr. Salar Ali

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KEYNOTE: Vulnerability of Pakistan to Climate Change Hazards

Profile:

Dr. Salar Ali is serving as a head of Environmental Science Department at University of Baltistan, Skardu. He has a M.Sc. and MPhil in Mountain Conservation & Watershed Management and Environmental Science, respectively. Dr. Salar Ali completed his PhD under CAS-TWAS President's Fellowship Program, Chinese Academy of sciences, China. He was only the candidate from Gilgit-Baltistan for this program in the year 2015 and was awarded as best international student conferred by the Nanjing government for the year 2017-18.

Dr. Salar Ali has an extensive teaching and research experience. He has worked with several international bodies including, International Centre for Integrated Mountain (ICIMOD), Environmental Protection Agency (EPA), German Development Cooperation (GTZ) & Program for Mountain Areas Conservation (PMAC). He has successfully completed five national & international projects. In his teaching profile, he has three years' experience as a lecturer at Karakoram International University and two years as an Assistant Professor at University of Baltistan, Skardu, Pakistan.

Dr. Salar Ali has published 27 international publications in impact factor journals and attended several international conferences and conducted seminars and workshops as an organizer. He is also contributing as a reviewer in the Journals of Environmental Pollution (Elsevier), Environmental Geochemistry and Health (Springer) & Ecological Engineering (Elsevier).

Abstract:

Temperature Increase by 1.1-6.4 0 C projected over the 21st Century, with most likely range being 1.8-4.0 0 C. The large changes associated with both, increases and decreases of temperature and precipitation in different world regions. Frequency and intensity of extreme climatic events and severe cyclonic storms, floods, droughts will increase considerably. Large scale melting of mountain glaciers and polar ice caps, particularly the Arctic results substantial rise in sea level. The venerability of water resources to climate change increase variability of monsoon and more rapid recession of Hindu Kush and Himalayan (HKH) glaciers threatening Indus River System (IRS) flows. The other challenges are Shortage of irrigation water for agriculture and increased risks of floods and droughts. Glaciers are life line of Pakistani rivers. The total water storage in glaciers in Upper Indus Basin (UIB) is 2,200 MAF and melt water from these Glaciers contributes more than 60% to the flows from UIB. International Commission for Snow and Ice (ICSI 1999) reported that the glaciers in Himalayas are receding faster than in any other part of the world and, if the present rate continue, the likelihood of them disappearing by the year 2035 is very high. The World Bank (2006) report shows that Western Himalayan glaciers will retreat for the next 50 years causing increase of Indus River flows. Then the glacier reservoirs will be empty, resulting in decrease of flows by up to 30% to 40% over the subsequent fifty years. International Panel for Climate Change (IPCC 2007) revealed that glacier melt in the Himalayas is projected to increase flooding within next two to three decades. This will be followed by decreased river flows as the glaciers recede. Hewitt (2005) reported widespread evidence of glacier expansion in the late 1990s in the Central Karakoram, in contrast to a worldwide decline of mountain glaciers. These conflicting findings make the impact of climate change on Karakoram glaciers and Indus River flows very uncertain. There is an urgent need to Assess Pakistan's glaciers, future water resources and storage requirements in the wake of climate change threat and to take appropriate ameliorative measures well in time to avoid calamites. Preparedness for disaster & risk management and development of early warning system will contribute to safeguarding the vulnerable communities.

Dr. Shafqat Ali

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KEYNOTE: Reduced Basis Methods for Parametrized Partial Differential Equations: A Stable and Less Expensive Approach

Profile:

Dr. Shafqat Ali is an Assistant Professor at GIK Institute - Ghulam Ishaq Khan Institute of Engineering Sciences and Technology. In his academic portfolio, he has B.Sc. Mathematics, Physics from Hazara University, Pakistan, MSc Mathematics from Quaid-I-Azam University, Pakistan, MPhil Applied Mathematics from Quaid-I-Azam University, Pakistan and PhD Applied Mathematics (Numerical Analysis) from International School for Advance Studies (SISSA), Italy.

In his professional career, Dr. Shafqat has acquired extensive teaching and research experience. He has worked on several research projects at International Centre for Theoretical Physics (ICTP), Italy, GIKI, Pakistan and Quaid-I-Azam University, Pakistan. He has also taught courses at Government postgraduate college Abbottabad, Department of Mathematics- Quaid-I-Azam University, Islamabad, Allama Iqbal Open University Islamabad, International Islamic University Islamabad and GIK Institute where he is currently working as Assistant Professor.

Dr. Shafqat has up to 14 national and international research publications. He has also presented his research in different conferences. Dr. Shafqat has also contributed as a reviewer for 08 international journals.

Abstract:

Several physical situations in sciences and engineering are expressed as parametrized partial differential equations, for instance, unsteady and steady heat and mass transfer, acoustics,

solid and fluid mechanics, electromagnetics, or problems of finance. In such models a number of input-parameters are used to characterize a particular problem and possible variations in its geometric configuration, physical properties, boundary conditions or source terms. The parametrized model implicitly connects these input parameters to outputs of interest of the model. To handle these models, several approximation techniques (finite element methods, finite difference methods, finite volume methods) are available in literature, but they are computationally expensive when dealing with several embedding parameters. In this talk I will present a reduced basis method (RB) which is computationally less expensive and gives the same accuracy as above-mentioned methods. In Reduced Basis (RB) method, the Galerkin projection on the reduced space does not guarantee the inf-sup approximation stability even if the stable Taylor-Hood Finite Element pair is chosen. Therefore, I will focus on the stability of this method.

Prof. Dr. Muhammad Ali Ismail

Professor

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KEYNOTE: Role of "Space Sciences" in Science & Technology Diplomacy

Profile:

Dr. Muhammad Ali Ismail, PhD, Senior Member IEEE & MIET is a Professor and Chair at Department of Computer and Information Systems Engineering, NED University of Engineering and Technology. He is also serving as Director High Performance Computing Center and Scientific Director Exascale Open Data Analytics Lab, National Center in Big Data and Cloud Computing at same University. He has more than 18 years' experience of research, teaching and administration in both national and international universities. He did his PhD in High Performance Computing in 2011. Afterwards he pursued his Post Doctorate in Automatic Design Space Exploration from ULBS Romania and became a HiPEAC member. He has published over 75 scientific papers in international journals and conferences along with U.S. patent. He has won many national and international grants of worth above Rs. 200 Million. He is also the recipient of Research Productivity Award by Pakistan Council for Science and Technology-Ministry of Science and Technology, Government of Pakistan. His current research interests include High Performance Computing, Computational Astrophysics, Big data mining, Cluster and Cloud Computing, Multicore processor architecture and programming, Machine learning, Heuristics and automatic design space exploration. He is also serving IET Karachi Network as its Vice Chairman.

Abstract:

In last few years, the interconnection between science and diplomacy has grown increasingly important that leads Science Diplomacy term that includes several kinds of research-based, scientific, academic and engineering exchanges among nations and societies. Now-a-days,

Science Diplomacy is being used for the scientific, technological and academic collaborations among countries, regions and societies to address common issues and to build sound international partnerships. Some of very common and latest examples include science diplomacy in pandemics (Covid-19, SARS, Ebola), science diplomacy in climate change (The Paris agreement, UN Fish Stocks Review) and science diplomacy in space sciences (The International Space Station, the Large Hadron Collider, Square Kilometer Array). This talk will be focused on the exploring the role of space sciences in Pakistan towards Science & Technology Diplomacy.

Dr. Muhammad Jawed Iqbal

Professor

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KEYNOTE: The Impact of Trends in South Asia Low Pressure Center on North Indian Ocean Air-Sea Heat Fluxes

Profile:

Dr. Muhammad Jawed Iqbal is serving as Professor and Director at Institute of Institute of Space and Planetary Astrophysics, University of Karachi. He is also working as visiting faculty at Department of Mathematical Sciences, IBA, Karachi. Dr. Jawed Iqbal has a BS, MS, M.Phil., PhD and a Post-Doctoral Fellowship. He also acquired certifications in Astronomy & Astrophysics and Atmospheric Dynamics from SUPARCO.

Dr. Jawed Iqbal has an extensive teaching experience having served at Federal Urdu University for Arts, Science and Technology, Karachi, IIEE, Karachi, NED University of Engineering and Technology, Karachi, Institute of Space and Planetary Astrophysics, University of Karachi, NCRS, Institute of Space Technology, Karachi, Department of Mathematics, University of Karachi, Department of Mathematics, University of Karachi, Department of Mathematical Sciences, IBA, Karachi and Institute of Space and Planetary Astrophysics, University of Karachi. He also proved his leadership skills through key administrative positions including Director Institute of Space and Planetary Astrophysics and Institute of Space and Planetary Astrophysics, University of Karachi.

In his professional career, Dr. Jawed Iqbal has attended and organized several national and international conferences and seminars. He has up to 50 national and 30 international journals published under his name. He is also serving as Associate Editor at Arabian Journal of Geosciences. Dr. Jawed Iqbal is a member of several national and international scientific bodies, including Board of Faculty of Science, University of Karachi, Academic Council, University of Karachi and American Geophysical Union (AGU), USA.

Abstract:

This paper examines the interannual variability of latent (LE) and sensible (H) heat fluxes over the North Indian Ocean for the summer season (June, July, August), that show positive linear trends during 1958 to 2017. Using Air-Sea Flux (OAFlux) from NCEP/NCAR reanalysis-I, the variability and trends in LE and H heat fluxes are compared with changes in the position and pressure of the South Asia Low (SAL). Investigation of interactions between the air-sea heat fluxes and SAL pressure center through correlations analysis and with analysis of composites of humidity gradient, temperature gradient and vector wind fields are carried out. The results show that the SAL plays an important role in the variability of air-sea heat fluxes over North Indian Ocean. There is a negative correlation between SAL pressure and its latitude position. A change of the SAL from a north location to a south location induces North Indian Ocean surface winds, humidity and temperature. These, combined with sea surface warming trends, produce trends in summer latent and sensible heat fluxes.

Dr. Rubina Waseem

Assistant Professor

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KEYNOTE: Space Law and Policy Predicament: A Case Study of South Asia

Profile:

Dr. Rubina Waseem is an Assistant Professor in the Department of Strategic Studies at the National Defence University. She is a former research fellow of The George Washington University Washington DC. She holds M.Phil. and M.Sc. degree in Defence and Strategic Studies from Quaid-I-Azam University, Islamabad. She has written several research papers and has participated in many national and international conferences to share her research work. Dr. Rubina has a strong background of research & training in the field of Strategic Studies with more than 9 years of teaching and research experience in the renowned universities of the capital city of Pakistan. Her research areas include non-proliferation, emerging technologies such as cyber and space technology and its impact on the contemporary strategic calculus.

Abstract:

The realization of space as the 'fourth medium of warfare' compelled the United States and the Soviet Union to expedite their research and development (R&D) to surpass each other. After the successful launch of Sputnik-1, the United States and the Soviet Union engaged in a space race by sending hundreds of satellites into different orbits around the Earth and beyond.

Space-based satellite systems are of vital importance for building military power of any country, as it provides necessary intelligence, surveillance and reconnaissance (ISR) of the opponent, both in peacetime as well as in crises situations. Primarily, satellites with military features were sent into outer space to get the ISR of the denied territories of the adversaries. In general, such early warning systems help to reduce the 'fog of war' and it helps the state in preparing a

quick and appropriate response before the adversary eventually launches an attack. Sun Tzu famously said that "if you know your enemies and know yourself, you will not be imperilled in a hundred battles." Taking this realism into account, knowing your enemy's ground and sea formation before any crisis situation would eventually increase the chances of survival in terms of giving a proportionate response to the adversary. This will not only increase a state's survival, but would also help in winning war, depending upon the level of understanding and knowing of capabilities of the adversary. Likewise, the appropriate deployment of ISR capabilities would reduce the chances of inadvertent, miscalculated, and unauthorized war between two adversaries.

States are actively pursuing their national defences in a relatively new medium of space, and one of a global common, with resources to conduct military operations in coordination with terrestrial warfare. This has brought a paradigm shift in the global security environment.

The paradigm shift has exacerbated the strategic environment of South Asia. An academic investigation of this new phenomenon will disclose the importance of space as a medium of warfare in shaping the global political environment and its implications on the regional security complex in South Asia more specifically in view of a security trilemma between China, India and Pakistan. This research endeavours to assimilate the strategic implications of an arms race in outer space in a more elaborated form so that the outer space medium of warfare can be better understood.

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

List of Accepted Research Papers

Institute of Space Technology

Sr. No.	Paper ID	Author's Name & Affiliation	Research Title
Aeronautics & Astronautics			
1.	1-AA-1	Obaid Ur Rehman *Beihang University, China*	Application Of Lotus Root Bionic Structure For Increment In Impact Load Bearing Capability Of A Satellite's Return Capsule
2.	1-AA-3	Osama Ali Ahmed Awan *Air University, Islamabad, Pakistan*	Recent Advancements in Thermal Barrier Coatings (TBC) for High-Temperature Gas Turbines
3.	1-AA-4	Obeid Muhammad Usmani *Air University, Islamabad, Pakistan*	Mathematical Modelling and Analysis of Submarine Propeller Shaft
4.	1-AA-5	Muhammad Ihtisham Babar *Pakistan Aeronautical Complex, Pakistan*	PanAir Study of Variation in Canard Location and Dihedral on Lift Characteristics of a Close-Coupled Wing-Canard Configuration
5.	1-AA-7	Hamza Ahmed Malik *Superior University, Pakistan*	Review On "Advance Seaplane Conceptual Design Adapting Trimaran Boat Hull Concept"
6.	1-AA-8	Sadia Azhar *Air University, Islamabad, Pakistan*	Modeling and Analysis of a Vibratory Bowl Feeder
7.	1-AA-12	Syed Muhammad Basit Ali *University of Management and Technology, Pakistan*	Design & Development of Static-Thrust Test-Bench for Aviation Based Piston Engines.
8.	1-AA-13	Muhammad Aitessam Ahmed *Institute of Space Technology, Pakistan*	Design and Development of Audio Processing and Speech Recognition Algorithm
9.	1-AA-17	Asim Mehmood *Institute of Space Technology, Pakistan*	Main Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V
10.	1-AA-18	Asim Mehmood *Institute of Space Technology, Pakistan*	Nose Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V

11.	1-AA-19	Abdul Rahim Tajammal *National University of Sciences and Technology, Pakistan*	Autonomous Control of a Quadcopter Using Machine Learning Algorithm
12.	1-AA-20	Abdul Rahim Tajammal *National University of Sciences and Technology, Pakistan*	Simulation of Human Cough and Sneeze Discharge in Confined Areas and Effective Ventilation System to Reduce COVID-19 Spread in Confined Areas
13.	1-AA-22	Hira Aftab *University of Management and Technology, Lahore, Pakistan*	Development of low cost wind tunnel for measuring lift and drag
14.	1-AA-24	Syed Saddam Ul Hassan *Air University, Kamra, Pakistan*	Generalised Modelling of Sound Signatures for Characterization of Multi-copter Unmanned Air Vehicles Based on Aero-acoustics Measurements and CFD Analysis
15.	1-AA-25	Zohaib Altaf *Air University, Kamra, Pakistan*	Aerodynamic Shape Optimization of Doubly Offset Serpentine Diffuser using Response Surface Methodology
16.	1-AA-26	Awais Munawar Qureshi *National University of Sciences and Technology, Pakistan*	Design and Development of a Vivaldi Antenna Array for Airborne X-Band Applications
17.	1-AA-27	Muhammad Ihtisham Babar *Pakistan Aeronautical Complex, Pakistan*	Robust Non-Linear Dynamic Inversion Control System To Improve Stability Of Large Aircraft In Crosswind
18.	1-AA-29	Zarrar *National University of Sciences and Technology, Pakistan*	Control System Design of Ornithopter Flapping Wing Unmanned Air Vehicle for Agile Performance
19.	1-AA-30	Muhammad Shoaib Ul Hassan *Institute of Space Technology, Pakistan*	Resolution Improvement In GNSS Based Synthetic Aperture Radar Using GPS L1 Signals From Multiple Satellites And Different Look Angles
20.	1-AA-31	Asra Imtiaz *Institute of Space Technology, Pakistan*	Evaluation Of Flight Mechanics Performance Of A Fighter Aircraft Using Computational Fluid Dynamics

21.	1-AA-32	Absar Ahmed Khan *Institute of Space Science and Technology, University of Karachi, Pakistan*	CFD Analysis of Multi-Element Natural Laminar Flow Airfoil NLF (1)-0115 for a Fixed Wing UAV
22.	1-AA-34	Maryam Ozair *Pakistan Space & Upper Atmosphere Research Commission, Pakistan*	Numerical Modeling and Simulation of Liquid Spray Atomization
23.	1-AA-36	Zukhruf Liaqat *National University of Sciences and Technology, Pakistan*	An Overview of Passive Flow Control Techniques in Supersonic Flows
24.	1-AA-38	Danial Ahmed Mir *Small Satellite Technology Research Lab, National Center of GIS & Space Applications, Pakistan*	Modern and Classical Control Techniques for Pitch Hold Autopilot of a UAV
Satellite Technology			
25.	2-ST-1	Muhammad Arqim Adil *Institute of Space Technology, Pakistan*	Possible Seismo-Ionospheric Anomalies Associated With the Earthquakes Occurred in 2018 Using GNSS TEC: A Statistical Analysis
26.	2-ST-2	Muhammad Sibtain Satti *Institute of Space Technology, Pakistan*	Possible ionospheric anomalies associated with 2019 Mw 5.4 Mirpur, Pakistan Earthquake from Swarm satellites
27.	2-ST-3	Muzamil Ali *Pakistan Institute of Engineering and Applied Sciences, Islamabad, Pakistan*	Design And Development Of A High Precision Thrust Measurement System
28.	2-ST-4	Daboor Sultana *Institute of Space Technology, Pakistan*	Analysis Of Atmospheric Anamolies Associated With Mw>6.0 Continental Earthquake In Afghanistan And Tajkistan
29.	2-ST-6	Hoor Bano *Institute of Space Technology, Pakistan*	Attitude Estimation & Control of a CubeSat Using Linear Quadratic Gaussian Approach

30.	2-ST-10	Usman Azeem *Institute of Space Technology, Pakistan*	Analysis and Comparison of Maximum Power Point Tracking Algorithms for Electrical Power System of CubeSats
31.	2-ST-11	Dr. Rehan Mahmood *Small Satellite Technology Research Lab, National Center of GIS & Space Applications*	High Performance On-Board Computer Architecture of ICUBE-N
32.	2-ST-12	Dr. Mohammad Tahir *International Islamic University, Pakistan*	Attitude Determination And Control of Small Satellite Using Conical Scan Earth Sensor and Magnetic Actuation
33.	2-ST-13	Dr. Rehan Mahmood *Small Satellite Technology Research Lab, National Center of GIS & Space Applications, Pakistan*	ICUBE-N: National CubeSat of Pakistan
34.	2-ST-14	Dr Rehan Mehmood *Small Satellite Technology Research Lab, National Center of GIS & Space Applications, Pakistan*	Dynamic Analysis of 3U iPOD Structure
35.	2-ST-15	Awais Munawar Qureshi *National University of Sciences and Technology, Pakistan*	Design and Development of a Portable Dish Antenna for SATCOM Man-Pack Terminal
36.	2-ST-16	Pawan Kumar *Institute of Space Technology, Pakistan*	Design and Simulation of Cost-efficient Reaction Wheel for 1U CubeSat
Information & Communication Technologies			
37.	3-ICT-3	Naeem Akhter *Pakistan Institute of Engineering and Applied Sciences, Pakistan*	Comparative Study of Image to Image Translation Models for Abnormal Weather Effects Removal
38.	3-ICT-5	Muhammad Ihtisham Babar *National University of Sciences and Technology, Pakistan*	Pick And Place Hand-Gestured-Robot For Physically Challenged People

39.	3-ICT-6	Afaq Ahmed *Bahria University, Pakistan*	Blockchain Based RFID Prototype For Medicine Traceability along the Healthcare Supply Chain
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Abstracts of Research Papers

Institute of Space Technology

1: Aeronautics & Astronautics

Paper ID: ICASE2021-1-AA-1

Application of Lotus Root Bionic Structure for Increment in Impact Load Bearing Capability of a Satellite's Return Capsule

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Nature has been astonishingly inspired man to look around and learn in various fields since ages. Lotus root design, being one of the famous inspiring techniques in recent era has been studied and applied to the structure of a Satellite's Reentry capsule. The paper presents a study related to improvement in the impact stress bearing capability in structure that strikes and lands on earth with a relatively high velocity despite the use of parachute. For achieving better structural designs, Bionics have been playing a significant role in almost every field. This paper presents a stress reduction of 10.18 % by the application of using a lotus root concept in the Return Capsule. Moreover, the distribution of stresses in the cross-sectional area of Reentry vehicle was analyzed and presented.

Keywords: Bionic structure, Re-entry capsule, FEM Analysis

Paper ID: ICASE2021-1-AA-3

Advances in Thermal Barrier Coatings (TBC) for High Temperature Gas Turbines

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Gas turbines are capable of producing tremendous amount of energy and have wide industrial applications due to their small size and lower weight. Their efficiency mainly depends on two factors i.e. turbine inlet temperature and compressor and/or turbine efficiency. By increasing the turbine inlet temperature, turbine blades face high temperature hot corrosion (850°C to 950°C) that limits the life of the turbine blade. During hot corrosion, molten sodium salts and vanadium oxide condense over the surface of turbine blades, consume protective oxide layers and diffuse into the microstructure of super alloy. As a result, fatigue and creep phenomena are accelerated leading to fracture. In this paper the use of hot corrosion resistant coating i.e. thermal barrier coatings has been investigated. Over the past few years it has proven to be an effective strategy to avoid premature failure. Hot corrosion reaction in conventional coatings transforms tetragonal zirconia to monoclinic phase and form large crystalline products which induces thermal stress and cracking upon cooling. While, nanostructured, rare earth elements co-doped and multiple layered thermal barrier coatings possess superior hot corrosion resistance than these conventional coatings. Also, high porosity in nanostructured, low reactivity of rare earth elements and diffusion hindrance of multilayered coatings resist hot corrosion processes. In conventional metallic bond coatings, hot corrosion destroys protective oxide layers and consumes aluminium and chromium contents. When reinforced with nanoparticles, rare earth elements and gradient aluminium layers, metallic bond coatings improve their hot corrosion resistance. These modifications develop continuous protective alumina and chromium oxide layer, prohibit diffusion of molten salts and increase aluminium content of bond coatings. Evaluation of coatings using XRD techniques, SEM spectroscopy and corrosion kinetics curves exhibit superiority of hot corrosion resistant coatings over conventional coatings.

Keywords: High temperature hot corrosion, low temperature hot corrosion, fatigue life, creep rate, thermal barrier coatings, nanostructured coatings, rare earth elements, gradient coatings

Paper ID: ICASE2021-1-AA-4

Mathematical Modelling and Analysis of Submarine Propeller Shaft

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In this research modeling, design and analysis of a submarine propeller shaft will be performed using theories of vibrations, the computer software will be used for this purpose mathematical simulations will also be done to verify the results obtained from the software. Vibration Analysis of a three Bladed Marine Propeller Shaft for a Bulk Carrier has been discussed in the literature, but not much work has been done till now on the vibrational response of a submarine propeller shaft. The dynamic excitation is usually transmitted through the propeller shaft to the rest of the submarine. Some submarines are subjected to intense levels of vibrations throughout their service additionally silent submarines have become a potent invention, which produces less noise at high speeds however higher vibration results in more noise-reducing the stealth characteristics of the submarines, in this research the propeller shaft will be modeled in such a way that the system vibrations are minimum hence increasing the life of the submarine, reducing the noise and increasing the stealth characteristics of the submarine, this analyses will be done by using theories of vibrations used finite element methods for modelling and analysis. The expected results from the analysis contain the least vibrations, produced by the propeller shaft of the submarine reducing the overall noise. Furthermore, their result help in the development of a system that besides increases the maneuverability of the submarine. We are able to successfully determine the vibration present in the system, and the approach on how to reduce them.

Keywords: Bladed Marine Propeller Shaft, Bulk Carrier, Stealth characteristics, Dynamic excitation.

Paper ID: ICASE2021-1-AA-5

Panair Study of Variation in Canard Location and Dihedral on Lift Characteristics of a Close-Coupled Wing-Canard Configuration

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In this article, a higher-order panel code is used to study the effects of the vertical and horizontal location of the canard as well as its dihedral on the lift of a closely-coupled wing-canard configuration. PANAIR is a higher-order potential code which solves Prandtl-Glauert equation in subsonic and supersonic regimes by distributing source and doublet singularities over a finite number of panels of a geometry. The available panel code is the pilot version of PANAIR, which is capable of computing aerodynamic coefficients for complex geometries. Being a potential flow code, PANAIR does not take into account the viscous aspect of the flow but gives quick and reasonable results for arbitrary configurations. To investigate the effect of location of canard, three horizontal and three vertical positions are considered based on the maximum thickness of the canard. Later, the effect of canard dihedral is investigated using one value of dihedral and a corresponding value of anhedral. It is concluded that addition of canard in plane of the wing decreases the lift but moving it towards the wing increases the lift. Shifting the canard above the wing plane also adds to the lift of the aircraft. Lastly, the effect of dihedral and anhedral is highly dependent on the vertical and horizontal location of the canard.

Keywords: Potential flow, PANAIR, panel method, canard location, canard dihedral, lift.

Paper ID: ICASE2021-1-AA-7

Advance Seaplane Conceptual Design Adapting Trimaran Boat Hull Concept

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The decline in the research of seaplanes started after 1950, when the focus shifted towards improving the infrastructure of land based aircrafts. Existing designs with minor improvements are being used since then. This review covers the ideas and initial performance predictions put forward in a research paper titled "Advance Seaplane Conceptual Design Adapting.

Trimaran Boat Hull Concept" presented at icas 2012(28 the international congress of the aeronautical sciences) by "a canamar, l smrcek", university of glasgow. The goal is to critically discuss the parameters one by one on the basis of which a specific design configuration of a seaplane is evaluated in this paper.

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Modeling and Analysis of a Vibratory Bowl Feeder

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Vibratory bowl feeders are required in industrial automation for the correct orientation of feed parts. These are considered to be efficient machines that are cheap and effective. The biggest disadvantage of the traditional vibratory bowl feeder is its inability to adapt to new designs, shapes, and orientations of the feed parts. Traditional vibratory bowl feeders are very inflexible and can work with only one orientation of the part. Although vibratory bowl feeders are considered to be traditional devices, these are now very much modernized and have adapted to

diversified industrial needs. Robotic arms are also often used along with the cameras to orient the parts. However, with the employment of robots comes a high cost, extensive maintenance requirements, and complexity in the assembly line. So a viable solution is to use the best features of both machines, i.e. while keeping the cheap effective and efficient qualities of a traditional vibratory bowl feeder, alter it to adapt to the changing part shapes and assembly lines. By doing so we can use the same vibratory bowl feeder for various orientations of components and in various assembly lines. This would eliminate the need for redesigning the vibratory bowl feeder with the orientation of each component, with which assembly line is not only expensive but also time-consuming. Thus we propose a resourceful, cheap, time-saving, and also flexible alternative. This is done by mounting cameras on the feeder, where the feed parts are fed. This camera can analyze the orientation of the part being fed and then compare it with the three-dimensional model fed to the system. It can then decide in which direction the part must be rotated to have the desired orientation. By using this technique, we can orient almost any part, which is being fed to the feeder with the traditional vibratory feeder, without the use of fancy equipment or robots, just by altering and modernizing the traditional vibratory feeder. This would make the traditional vibratory bowl feeder, a device that is very flexible and can adapt to the changing feed, solving many problems. We can thus alter an already available system, to become versatile and adaptable, in numerous assembly lines for different parts, with very little alteration to the already existing systems.

Keywords: Vibratory bowl feeders, Feed, Two degrees of freedom system, Response graphs.

Paper ID: ICASE2021-1-AA-12

Design & Development of a Static-Thrust Test-Bench for Aviation/ UAV Based Piston Engines.

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Internal combustion engines have been pioneers in the aviation industry, use of piston engines for aircraft propulsion, from propeller-driven bi-planes to turbo-prop, commercial and cargo airliners. To provide an adequate amount of thrust piston engine rotates the propeller at a specific rpm, allowing enough mass airflow. Thrust is the only forward-acting force of an

aircraft that helps heavier than air bodies to fly. Depending on the mathematical model and variables included in that with correct measurement. Test-benches have been a bench-mark in the aerospace industry to analyse the results before a flight, having paramount significance in reliability and safety engineering. Depending on the mathematical model and variables included in that with correct measurement. Calculation of thrust from a piston engine also depends on environmental changes, the diameter of the propeller, and the density of air. The project would be centered on piston engines used in the aviation industry for light aircraft and UAVs. A static thrust test bench involves various units, each performing a designed purpose to monitor and display. Static thrust tests are performed on the ground and safety concerns hold paramount importance. The execution of this study involves research, design, manufacturing, and results based on reverse engineering initiating from virtual design, analytical analysis, and simulations. The final evaluation of results gathered from various methods such as co-relation between conventional mass-spring and digital loadcell. On average we received 17.5kg of thrust (25+ engine run-ups – around 40 hours of engine run) only 10% deviation from analytical calculated thrust – providing 90% accuracy.

Keywords: Aeronautics, Evaluation, Static-Thrust, Test-Bench, Piston Engine

Paper ID: ICASE2021-1-AA-13

Design and Development of Audio Processing and Speech Recognition Algorithm

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Speech recognition is the emerging technology in the field of artificial intelligence, as humans find easier to communicate and express their ideas via speech. Many state-of-the-art speech recognition systems have been designed in recent years after the innovation of GPUs, however, these cannot perform well in real-time on low-power processors. Therefore, this paper shows the development of an intelligent deep learning-based speech processing algorithm that was implemented on a quadcopter for simplifying the process of UAV control. The developed algorithm can also be used for other applications after integration with other systems such as automated data entry in ATMs and vending machines, home/office automation, speech-

controlled vehicle navigation, and wheelchair operation. At first raw speech signals were converted to 2D spectrograms and then passed to the Convolutional Neural Network. ImageNet based pre-trained ResNet50 model was fine-tuned for the used audio dataset that required minimal feature and model design. After training using cloud GPU on Kaggle notebook, the model achieved the state of art results with 97.1% training accuracy and 96.45% validation accuracy. Then weights of the model were saved and algorithmic program was coded on python using Keras library backend with Tensorflow and an optimized algorithm was implemented on Jetson Nano for real-time transmission on the quadcopter. Speech commands were sent to the quadcopter for its real-time flights and it maneuvered successfully in a guided direction.

Keywords: Speech Recognition using 2D CNN, Speech Controlled Quadcopter, Deep Learning Based Speech Recognition, Fine-tuning of Pre-Trained ResNet-50 for Audio Classification.

Paper ID: ICASE2021-1-AA-17

Main Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V

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Among the major components for any Unmanned Combat Aerial Vehicle (UCAV) landing gear is of significant importance, as it performs the function of supporting weight, shock-absorbing structure, taxiing, and providing stable ground support during the nonoperational period, Takeoff and at the most critical phase of Landing. This study presents the Conceptual Design, Preliminary Structure Design, Sizing and Stress Analysis, Finite Element Analysis for Medium Altitude Long Endurance Unmanned Combat Aerial Vehicle (MALE UCAV) adhering to the C-23 Certificate Specification. The MALE UCAV design was carried out by different groups and this study is a part of that program. The conceptual design was carried out by fulfilling the preset constraints of Main Landing Gear weight, its height, and location. Tri-cycle layout configuration was selected and geometric parameters such as Wheel track and Wheel base and other parameters were worked out. A detailed study of all the possible loading conditions

was conducted and the most critical and maximum loads were selected for sizing and stress analysis. Two candidate materials were selected and based on the Normal stress and Shear stress criteria, simultaneously sizing and stress analysis was carried out leading to the desirable design of the Main Landing Gear strut. Finite Element Analysis was performed on the designed Landing Gear for three models and the design fulfilling our requirements was selected.

Keywords: landing gear, Main Landing Gear, landing gear conceptual design, strut sizing, sizing and stress analysis, landing loads, finite element analysis landing gear

Paper ID: ICASE2021-1-AA-18

Nose Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V

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Among the major components for any Unmanned Combat Aerial Vehicle (UCAV) landing gear is of significant importance, as it performs the function of supporting weight, shock-absorbing structure, taxiing, and providing stable ground support during the nonoperational period, Takeoff and at the most critical phase of Landing. This study presents the Conceptual Design, Preliminary Structure Design, Sizing and Stress Analysis, Finite Element Analysis, Drag Strut design, and Design of Oleo Pneumatic Shock Absorber which is incorporated into Nose Landing Gear (NLG) strut for Medium Altitude Long Endurance Unmanned Combat Aerial Vehicle (MALE UCAV). The MALE UCAV design was carried out by different groups and this study is a part of that program. The conceptual design was carried out by fulfilling the preset constraints of Nose Landing Gear weight, its height, and location. Tri-cycle layout configuration was selected and geometric parameters such as Wheel track and Wheel base and other parameters were worked out. A detailed study of all the possible loading conditions was conducted and the most critical and maximum loads were selected for sizing and stress analysis. Two candidate materials were selected and based on the Normal stress and Shear stress criteria, simultaneously sizing and stress analysis was carried out leading to the desirable

design of the Nose Landing Gear strut. The finalized design was modeled and FEA was carried out and results were obtained.

Keywords: landing gear, Nose Landing Gear, landing gear conceptual design, strut sizing, sizing and stress analysis, landing loads, finite element analysis

Paper ID: ICASE2021-1-AA-19

Autonomous Control of a Quadcopter Using Machine Learning Algorithm

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There has been an increase in the applicability and potential use of UAVs in civil, commercial, engineering, and military applications, during the recent years. These UAVs/Quadcopters are generally designed to operate in known and stable environmental conditions. Since usually the dynamics of the environment are not known, Machine Learning provides the techniques for using intelligent control systems that can perform desired tasks in such unknown conditions. This paper provides a framework using a Machine Learning algorithm to enable UAV navigation in such environments through the implementation of an intelligent reinforcement learning controller. It includes detailed modelling of a quadcopter, based on the Newton-Euler equations of forces and moments and its controller design using Python. A conventional PID controller has also been used to find the linearized response of the quadcopter. The results obtained are shown by the help of simulations and time plots of the state space vector are given. Furthermore, the quadcopter is made to follow certain trajectories to determine the accuracy of the autonomous controller.

Keywords: UAVs, reinforcement learning, DDPG, PID Newton-Euler, machine learning, Simulink

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Geometric Sensitivity of Static Equivalent Modeling Techniques for Honeycomb Cores

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The basic purpose of this project was to make a ventilation system for a room to remove the sneeze particles inside it. The spread of germs was to be studied. Different cases with different inflow conditions and different locations of the ventilation sources were created and the computational fluid dynamics analysis was carried out using the utility of ANSYS software Fluent. The geometry and mesh were created in ICEM CFD, and the analysis was carried out using the Discrete Phase Method (DPM) in ANSYS Fluent. The Reynolds Averaged Navier Stokes model (K - epsilon) was used to capture turbulence and in the initial cases the volume of fluid method was used to capture multiphase. It was observed that when there was no ventilation source, the cough spread in the room and then was settled on the ground in the room. But when ventilation source (fan) was introduced, the cough particles merged with the airflow and exited the room through the outlet. As the velocity of the fan was increased, it was observed that the number of cough particles exiting the room through the outlet increased. The results obtained shows that the cough comes out from the velocity inlet. The volume fractions show the actual path taken by the cough, the velocity vectors show that the germs in the cough comes down due to gravity and gathers at the lower surfaces. The results showed that the case with exhaust was perfect and with changing the location of the exhaust, it was concluded that the exhaust which was at the bottom of the room with inflow condition of 10 m/s was best case scenario. The results obtained were according to the literature and will help to design a ventilation system for a room to clean the spread of germs due to human cough.

Keywords: Discrete Phase Method, ICEM CFD, cough, RANS.

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Development of Low Cost Wind Tunnel for Measuring Lift and Drag

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The paper discusses the construction and working principle of low cost subsonic open circuit wind tunnel. The open circuit wind tunnel can produce 0.03 Mach and Reynolds number of 1.76*10^5 with velocity of 9.5m/s inside the test section. The wind tunnel can measure the lift and drag over the airfoil NACA 0012. The dimensions of the airfoil are selected according to the dimensions of the test section. The airfoil comprises of specific material and the pressure taps are made by passing pressure lines inside the airfoil. The wind tunnel is equipped with nine electrical fans that passes the airflow over the airfoil. Lift and drag measurement is done by using pressure ports that are made chord wise on the airfoil. Digital manometers attached with the pressure ports by pressure lines. Manometer reading about the coefficient of pressure used for finding the lift and drag using integration. The airflow across the airflow is made visible by using smoke system inside the wind tunnel. The smoke system uses fog machine and reservoir. In the test section this smoke in converted into linear pattern by using a number of copper tubes. Quantitative measurements of lift and drag compared with experimental graphs of the wind tunnel experiment using same airfoil.

Keywords: Wind tunnel, Reynolds number, airfoil, lift, drag, manometer, subsonic

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Generalized Modelling of Sound Signatures for Characterization of Multi-Copter Unmanned Air Vehicles Based on Aero-acoustics Measurements and CFD Analysis

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In this research work, the aim is to characterize the aeroacoustic signature of multi-copter Unmanned Air Vehicle based on the FW-H acoustic analogy. Characterization of single propeller sound signature and quad-copter's sound signature has been done, so that the two sound signatures can be compared and generalized characterization scheme for every multi-copter UAV configuration can be formulized. Unstructured grid has been used. The flow is being simulated by using Large Eddy Simulation turbulence modelling technique and to estimate the acoustics level at the specified receiver locations, FW-H acoustic analogy is being utilized in the ANSYS Fluent® environment. Aeroacoustic signature pattern is recognizable on the basis of tonal frequency which is a function of Blade Passing Frequency (BPF) and the number of propellers being used on the respective configuration of multi-copter UAV. Sound pressure varies logarithmically in any particular direction with distance and shows unsymmetrical behaviour on a radial plane because of acoustic wave interaction with each other in case of downstream of multi-copter but for single propeller the result is nearly symmetric.

Keywords: Large Eddy Simulation, CFD, Aero-acoustics, Acoustic analogy, FW-H equation, Multi-copter UAV, Detection

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Aerodynamic Shape Optimization of Doubly Offset Serpentine Diffuser using Response Surface Methodology

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Doubly offset serpentine diffusers have gained popularity in the compact design configurations of modern stealth fighters and UAVs with highly integrated propulsion systems into the airframe. In this research, the design space of a doubly offset serpentine diffuser is explored and the numerical optimization of its shape variables is achieved using response surface methodology to maximize total pressure recovery at the Aerodynamic Interface Plane between the engine and inlet. The stream-wise and transverse pressure gradients in the baseline diffuser are controlled using area distribution and centerline distribution equations respectively. The original geometry is perturbed using the control points distributed uniformly along the centerline and the central composite design has been used to select a pool of candidate designs. Steady-state flow solutions have been achieved using governing Reynolds averaged Navier-Stokes equations applied through the general-purpose computational analysis tool ANSYS Fluent. A response surface is constructed out of the training data by fitting quadratic polynomials to the pressure recovery coefficients. The optimal diffuser design is found using Sequential Quadratic Programming (SQP) algorithm from the response surface approximations. The optimized shape encompasses potential improvement in the total pressure recovery by 1.1% as compared to the baseline geometry. Results reveal that diffuser performance is a complex function of its geometric shape and any slight change in its shape variables may lead to significant performance degradation.

Keywords: Doubly offset serpentine diffuser; response surface modeling; pressure recovery

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Design and Development of a Vivaldi Antenna Array for Airborne X-Band Applications

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In this paper, design analysis of an X-band Vivaldi antenna array for airborne active phased array radar application has been presented. Initially, a parametric study has been conducted to find out the relationship between design characteristics of a Vivaldi antenna array and its performance. Thereafter, a single Vivaldi antenna leading to 1x8 uniform linear array was designed to achieve optimal performance before proceeding to 8x8 antenna array design. Moreover, the tuning and optimization of designed antenna array have also been performed to achieve the desired results. The stripline to slotline transition in the feeding section was adopted to adhere to the size restrictions of airborne radar system. The designed antenna array operates in X-Band with a center frequency of 10 GHz. It comprises an array of 64-elements (8x8) and achieves a 22 dB gain. The return loss (S11) is better than -10 dB in 2 GHz bandwidth (8.55 – 10.75 GHz). With a transmitted peak power of 640 W, the Azimuth and Elevation coverage is ±60° and beam width is 13°. The isolation between two elements is 20 dB and Side Lobe Levels (SLL) are -30 dBc. The designed single-element Vivaldi antenna and uniform linear 1x8 elements Vivaldi antennas array has been fabricated to develop 8x8 elements antenna array. The return loss parameter and radiation patterns of all prototypes have been found in good agreement with simulation results. Rogers 5880 substrate with 1.57 mm thickness has been utilized for fabrication. The design and simulations analysis have been performed in ANSYS HFSS EM simulation platform and Gerber files have been generated through ADS for fabrication.

Keywords: ADS, ANSYS HFSS, Linear Array, Parametric Study, Vivaldi Antenna, X-band

Paper ID: ICASE2021-1-AA-27

Robust Non-Linear Dynamic Inversion Control System to Improve Stability of Large Aircraft in Crosswind

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This paper presents a detailed description of a flight stability and control system, along with the original and improved lateral response of large aircraft in crosswind as experienced during landing. A robust state-dependent non-linear dynamic system is designed and used in the proposed approach to improve aircraft stability in crosswind disturbances. Furthermore, to demonstrate the effectiveness of the designed system, two large aircraft, the Boeing 747 and the Galaxy C-5, are used as a baseline, as both are widely used in the aviation industry. The response of the non-linear Dynamic Inversion is also demonstrated for varying crosswind behavior and magnitudes. Another benefit of the Non-Linear Dynamic Inversion control system is in the creation of an autopilot system which is achieved through non-zero state tracking for an aircraft. It is concluded that by incorporating the designed robust Non-Linear Dynamic Inversion, as a stability and control system for both these aircraft, an improved aircraft response and behavior of control surfaces can be obtained.

Keywords: Lateral Stability, Crosswind Disturbance, Non-Linear Dynamic Inversion, Control Augmentation Systems, Stability Augmentation System, Large Body Aircraft Response

Paper ID: ICASE2021-1-AA-29

Mathematical Modeling and Control System Design of Flapping Wing Unmanned Air Vehicle

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In recent technologies, development of flapping wing UAVs has evolved to mimic bio inspired flapping wing for multiple purpose applications due to their ability to fly at lower speed silently. Flapping Wing UAVs are becoming vital in modern era due to their diversified use and ability to serve several public and defense needs for SWARM mission and espionage. The use of UAVs is offered as a competitive alternate to many other platforms. This research focuses on mathematical modeling, aerodynamic modeling, control design and hardware implementation of flapping wing ornithopter unmanned air vehicle. Ground control station design has been incorporated in order to provide reception of real time telemetry. Mechanical test benches design and developed for pitch and yaw control for the testing and verification of controllers with live plotting of responses using data logging. Results of various forces that mainly include thrust, lift, drag, gust and aerodynamic are analyzed. In order to make the autonomous ornithopter, parameters calculation and aerodynamic profiling has been performed for robust and autonomous control design with map navigation from ground station.

Keywords: Ornithopter, MATLAB, Flapping Wing UAV, PID Control, LabVIEW, Ground Control station (GCS)

Paper ID: ICASE2021-1-AA-30

Resolution Improvement in GNSS Based Synthetic Aperture Radar Using GPS L1 Signals from Multiple Satellites and Different Look Angles

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The Global Positioning System (GPS) is used to calculate position of a user and navigation purposes around the globe. This paper describes a way to use reflected GPS signals to obtain images of the targeted area of interest with improved resolution. The GPS signals reflected from different objects on surface of earth could be used in different remote sensing applications because they provide valuable information about reflecting surface. Generally, the principle is based on a kind of synthetic aperture radar (SAR) which image reconstruction is performed by using a technique called matched filter. The process to generate GPS signal and reconstruction of image is simulated for different time periods on MATLAB. Different point target based scatter images of the interested area are obtained with the help of SAR signal processing techniques. Later on these obtained images are combined by image fusion using stationary wavelet transformation (SWT) technique to improve the resolution.

Keywords: GPS, Bistatic synthetic aperture radar, SAR signal processing, Image Fusion

Paper ID: ICASE2021-1-AA-31

Resolution Improvement in GNSS Based Synthetic Aperture Radar Using GPS L1 Signals from Multiple Satellites and Different Look Angles

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F-104 Starfighter has always been considered as a marvel in the field of engineering because of its design and ability to sustain flights at higher speeds. The aim of this research is to examine the viscous, compressible and steady state flow over this vintage aircraft using modern computational techniques and validate the results using flight data and results from Advanced Aircraft Analysis (AAA). The second objective of the research is to carry out the analysis on the scaled down model and comparing the results to flight conditions thus defining the technique as a substitute for wind tunnel testing.

Keywords: F-104, CFD, Mach number, CAD, FLUENT, AAA

Paper ID: ICASE2021-1-AA-32

CFD Analysis of Multi-Element Natural Laminar Flow Airfoil NLF (1) - 0115 for a Fixed-Wing UAV

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As the use of composite structures in the aerospace vehicles have significantly increased over the years, it has now become possible to acquire levels of surface smoothness and tolerances by using the laminar airfoil. Studies have shown that the use of Natural Laminar Airfoil (NLF) results in substantial gains in the performance of aerospace vehicle. On the other hand, the deployment of slats and flaps in NLF airfoils is a fairly novel concept allowing substantial

enhancement in the aerodynamic performance as compare to a single-element NLF airfoil. Of late, various attempts have been made to exploit NLF airfoils, however many studies have shown that the harnessing of optimized results has not met notable success. For instance, as the laminar flow reaches the leading-edge (LE), it faces significant loss owing to the contamination at the LE that results in the reduction of the lift coefficient (Cl). This creates hazardous situation during the takeoff and landing. In this paper, the NLF (1)-0115 with max thickness 15% at 44.1% chord and max camber 1.8% at 30% chord is used to design a 2-D multi-element airfoil with slat and flap for an Unmanned Aerial Vehicle (UAV). The multi-element airfoil is designed and analyzed on Ansys Fluent using Spalart-Allmaras (S-A) turbulence model for various Reynolds and Mach numbers where the loss of lift coefficient due to contamination is expected to be minimal, simultaneously the low drag coefficient is expected to occur. While the low-drag benefit as a result of the laminar flow could be achieved during the cruise flight, the use of such airfoil in a UAV shows rich potential for meeting mid and far-term objectives of slashing the UAV energy whether fossil or electric.

Keywords: Natural Laminar Flow, Multi Element Airfoil, Ansys Fluent, Unmanned Aerial Vehicle, NLF (1)-0115, Aerodynamics, Energy

Paper ID: ICASE2021-1-AA-34

Numerical Modeling and Simulation of Liquid Spray Atomization

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Liquid sprays are used in a variety of industrial applications such as, inlet fogging of gas turbines, drug delivery in pharmaceutical industry, spray combustion in rocket engines and diesel engines, paint spraying, thermal spraying, and for applying agricultural chemicals to crops. Understanding spray atomization process and predicting accurate droplet size distribution is important for an effective spray nozzle operation and, thus for producing a highly-efficient spray system. In the present work, numerical modeling and simulation of liquid spray atomization is performed for two different pressure-swirl nozzles: one operating at a low pressure of 5 bar, whereas the other operating at a high pressure of 138 bar. For spray modeling, an Eulerian-Lagrangian approach is used. Particles of liquid are introduced into the gas phase. The gas

phase is is solved using Navier-Stokes equations as the phase is considered as a continuum. The liquid particles are tracked in the computed gas phase. The objectives are to predict the droplets size, and evaluate the numerical approach used in this work. The results obtained from simulations are compared with experimental data for the validation of the numerical approach used in this work. The computed values of Sauter mean droplet diameter compare favorably with the experimental data.

Keywords: Droplets size, Lagrangian discrete phase model, Pressure swirl nozzle, Sauter mean diameter

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An Overview of Passive Flow Control Techniques in Supersonic Flows

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Fluid flow is characterized by active and passive controls. Active flow control exploits external energy to control flow externally and internally. However, passive flow control uses physical devices to regulate the flow of the fluid without incorporating any auxiliary power. Passive control is inherent to air vehicles to achieve desired characteristics smoothly. Most of the times, passive flow control devices are installed at the time of the manufacturing. These devices also come as external kits. The shape and size of the device being installed determines the pressure regulation, and the boundary layer effects are prominent in such cases. Several techniques are discussed in this paper with a focus on how they achieve desired flow characteristics by pressure regulation and ultimately contribute positively towards required flight characteristics. Some common passive flow devices include vortex generators, tabs, leading edge slats, cavities, and flow vanes. These physical devices do not need an external energy and change pressure distribution to a desirable form through geometric changes of the surfaces. The phenomena of flow separation and stall are of significance when passive flow techniques are under consideration. The weight and Auxiliary energy, boundary layer, control devices, flow characteristics, flow separation, passive flow, supersonic regime, and vortex generation. drag may experience slight increase but a cost-efficiency trade-off is made to achieve optimum results. The aim behind

flow control is to regulate pressure recovery and remove unsteady pressure changes. The techniques of passive flow control are widely used because of their simplicity, affordability, and accessibility.

Keywords: Auxiliary energy, boundary layer, control devices, flow characteristics, flow separation, passive flow, supersonic regime, and vortex generation.

Paper ID: ICASE2021-1-AA-38

Modern and Classical Control Techniques for Pitch Hold Autopilot of a UAV

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The present paper discusses the trade-offs between classical and modern controllers by designing a pitch hold autopilot for of yak54. Autopilots decreases the workload of pilots, making the flight more reliable and efficient. A pitch controller is initially designed using a classical technique, where root locus and Bode plots are studied to design a suitable feedback controller. Linear quadratic integrator (LQI), with a stable inner loop, is also synthesized to control the pitch attitude of yak54 using tools available in MATLAB. The classical and modern controllers are compared, and trade-offs of the designed controllers are discussed, supported with simulation results obtained via MATLAB.

Keywords: Flight control, classical control, handling qualities, LQI, tuning

2: Satellite Technology

Paper ID: ICASE2021-2-ST-1

Possible Seismo-Ionospheric Anomalies Associated with the Earthquakes Occurred in 2018 Using GNSS Tec: A Statistical Analysis

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The recent advances in space-based ionosphere measurements provide more detailed information about momentary ionospheric anomalies preceding earthquakes (EQs). In this paper, we study the possible relation of EQs and ionospheric anomalies for 11 EQs that occurred in 2018 by analyzing Total Electron Content (TEC) acquired from the Global Navigation Satellite System (GNSS). The selection criteria of these EQs are mainly subjected to two conditions: (1) there should be at least three International GNSS Service (IGS) permanent stations falling around the EQ preparation zone; (2) the EQ should occur during the quiet geomagnetic activity (Kp≤3, Dst≥-20). We perform a statistical analysis based on sliding median and interquartile range (IQR) over TEC for 15 days before and 5 days after each EQ that shows abnormal variations within 10 days before all these EQs. Our analysis shows that the possible EQ-induced TEC anomalies have deviated averagely ~4 TECU, with a percentage deviation of about 44%, from the corresponding upper bound (UB) during quiet geomagnetic activities (Kp≤3). Whereas the other TEC anomalies induced by moderate geomagnetic activities of ~4 Kp show relatively fewer deviations of about 3 TECU (~37%) from the corresponding UB. Moreover, we did not find any proportionality between TEC anomalies and the magnitude of the EQ. However, the sequential EQs, including fore and aftershocks, exhibit a strong proportionality between TEC anomalies and days before EQ. Conversely, our results also explicate the complexness of finding an ionospheric EQ precursor even in such quiet geomagnetic activities.

Keywords: Ionosphere anomalies, GNSS-TEC, Earthquake Precursors, Geomagnetic activities

Paper ID: ICASE2021-2-ST-2

Possible Ionospheric Anomalies Associated with 2019 Mw 5.4 Mirpur, Pakistan Earthquake from Swarm Satellites

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The advances in monitoring of ionospheric anomalies from space instruments aid in the development of lithosphere atmosphere ionosphere coupling (LAIC) hypothesis over the epicenter of impending earthquake (EQ). In this paper, multiple ionospheric parameters are analyzed from Swarm three satellite (Swarm A, B, and C) over the epicenter of Mw = 5.4 Mirpur, Pakistan EQ on September 24, 2019. The analysis of electron density (Ne), Slant Total Electron Content (STEC) and electron temperature data is investigated for possible seismo ionospheric anomalies from European Space Agency (ESA) Swarm-three satellites before and after the main shock. This paper aims to study and interpret the anomalies in the aforementioned data, before, during and after the mentioned earthquake. Anomalies are investigated in the data for 2 months before to 2 months after the main shock within the Dobrovolsky's area. In this study, satellite Alpha, Bravo and Charlie clearly shows anomalies in plasma density, STEC starting from 40 days to 6 days before prior to the EQ main shock. This study helps us to understand the physical processes over the preparation zone and may validate the LAIC within seismogenic zone for future EQ.

Keywords: Lithosphere Atmosphere Ionosphere Coupling, Ionospheric Anomalies, Swarm-three Satellite, Earthquake

Paper ID: ICASE2021-2-ST-3

Design and Development of a High Precision Thrust Measurement System

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One of the fundamental steps in the applications of science and technology is the measurement of physical quantities involved in those applications. The measurement of these physical quantities is, however, not always trivial. In the applications such as the calibration of femto-satellites, and micro-plasma thrusters for future space exploration missions of NASA and other technological giants, where very precise attitude and position control is required, the measurement is a key issue to be addressed. One of such applications is a low-cost thrust measurement system. This paper presents the design and development of such a system, capable of successfully measuring the thrust of magnitude less than 20 μN by utilizing the principles of optical interference. The micro newtons pulse of a short duration is applied using an electromagnetic thruster setup on the tip of a pendulum. The pendulum subsequently performs the oscillations, and then an optical interferometer is used to precisely measure the deflection of the pendulum. The maximum deflection is then calibrated to obtain the applied thrust. The pendulum is designed based on optimal geometric parameters for maximum deflection of the pendulum tip for a response of thrust lasting for 100 milliseconds. For experimental validation, the interference signal is obtained in high resolution oscilloscope, which is subsequently processed to find the precise deflection of the pendulum and thus the precise thrust. The device successfully measures a minimum thrust of 18.44 μN. The precision is restricted due to environmental conditions and is not the limitation of the device itself.

Keywords: Precision Thrust Measurement, Interferometry, Micro-Thrusters, Meteorological Devices, Space Technology

Paper ID: ICASE2021-2-ST-4

Analysis of Atmospheric Anomalies Associated with Mw>6.0 Continental Earthquake in Afghanistan and Tajikistan

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The recent advances in space based atmospheric precursors of earthquakes aid in the development of lithospheric atmospheric coupling system. In this paper, atmospheric anomalies associated with three Mw>6.0 continental earthquakes in Asian countries (Afghanistan and Tajikistan) are analyzed. The atmospheric precursors are searched in humidity, Aerosol Optical Depth (AOD) and soil moisture from Giovanni (A Web interface to analyze NASA's gridded data). Pre atmospheric anomalies are observed before all three earthquakes during 5- 50-day window beyond the upper bounds. On the other hand, post atmospheric anomalies are only observed after Mw 7.0, Afghanistan earthquake within 5 days. The overall analysis shows that pre atmospheric anomalies can be monitor more frequently than post atmospheric anomalies; however, more analyses need to clear the lithosphere atmosphere coupling. There is lack of possible precursors of earthquakes but the need for more analysis can certainly validates the phenomenon.

Keywords: Earthquake, Atmospheric anomalies, Mw> 6.0, Lithospheric-Atmospheric Coupling, AOD, Humidity, Soil Moisture

Paper ID: ICASE2021-2-ST-6

Attitude Estimation & Control of a CubeSat Using Linear Quadratic Gaussian Approach

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Attitude estimation of satellites using Kalman Filters has been in practice for many years. The optimal attitude control in the presence of noise can be achieved by using the optimal controller and the optimal estimator simultaneously. In this paper, the Linear Quadratic Regulator (LQR) has been implemented in conjunction with the Extended Kalman Filter (EKF) on a CubeSat model. The full quaternion modelling (dynamics & kinematics) of the CubeSat is employed for the design of LQR. Furthermore, an extended Kalman filter is designed using the reduced quaternion model. The filter is then implemented in the closed loop with the LQR, and the simulations are conducted. The data generation using the full quaternion model and the filter implementation using the reduced model, provide the benefit of computational ease all the while catering for any singularities in the model. The simulation results show adequate attitude control, estimation and noise filtration within a reasonable time and optimum control effort.

Keywords: CubeSat, Quaternion Modelling, LQR, EKF, LQG

Paper ID: ICASE2021-2-ST-10

Analysis and Comparison of Maximum Power Point Tracking Algorithms for Electrical Power System of CubeSats

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The Photovoltaic System (PV) is one of the most common renewable sources of energy being used over decades. We are concerned with reducing cost and improving efficiencies today so these natural resources can be tapped and utilized effectively. Using a maximum point

tracker (MPT), it is possible to extract maximum power from a PV panel. PV systems have varying output powers based on changes in temperature and irradiance. Charger efficiency must be enhanced. Several maximum power point tracking (MPPT) methods are available to achieve the maximum point, for example Incremental Conductance method (INC), Perturb and Observation method (P&O), and Constant Voltage method. To measure and evaluate the performance parameters and to test the efficiency and validity of the proposed controller, an entire PV system will be modeled and simulated with Simulink. On the design level, we used Incremental Conductance Method (INC) and Perturb and Observe (P&O) MPPT algorithm. For comparison purposes, the output data of the MPPT is compared to find a significantly better MPPT system.

Keywords: MPPT (Maximum Power Point Tracking), Photovoltic Panel (PV), INC (Incremental Conductance), P&O (Perturb and Observation), Boost converter, Buck Converter, Buck-Boost Converter.

Paper ID: ICASE2021-2-ST-11

High Performance On-Board Computer Architecture of ICUBE-N

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A satellite or spacecraft is based on different subsystems like Power system, Attitude control, Payloads and Communication systems that all need to work together as an integrated system for data communication according to the mission requirements. The efficient linkage between different modules is required to maintain and increase the performance and the life of spacecraft for its survival in space. OBC is basically the brain of satellite which consists of microcontroller, memory banks, communication protocols and interfacing chips to communicate with other subsystems. This paper presents the steps involved in the development of high-performance On-Board Computer. The study covers the selection of microcontroller based on performance, capacity, its flight heritage and current evolution in microcontrollers. 32-bit microcontrollers are emerging because of their high performance and extended features. Then the selection of external memories which are required to store data coming from different boards. Also, the communication protocols and interfacing IC are selected based on accuracy and speed. The power and the cost of selected components is calculated. This design of an OBC is also suitable for Attitude Determination and Control Subsystem applications.

Keywords: On-Board Computer (OBC), Microcontrollers, External memories, Communication protocols, Interfacing chip, Power, Cost, Attitude Determination and Control Subsystem (ADCS).

Paper ID: ICASE2021-2-ST-12

Altitude Determination and Control of Small Satellite Using Conical Scan Earth Sensor and Magnetic Actuation

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This paper explains the comparison between different types of sensors and actuators used to measure and control the orientation of the spacecraft to determine spacecraft position in space and direction in which it is pointing its target. Typically, sensors used for this purpose are Magnetic, Star, Sun, Earth and Gyro sensors. While, actuator on the other hand is the reaction of the sensor which cause motion or action to keep satellite in the right orientation. For possible two types of controls, active and passive controls [1], we will discuss actuators like reaction wheel, magnetic torque bars and thrusters. The major constraints that take place for small satellite configuration are mainly, size, cost and power specification. Considering all of these, appropriate sensors (magnetometer, sun sensor and earth sensor) are used for low earth orbit (LEO). Presently, use of conical scan earth sensors are being genuinely studied and found to be effective for the use of attitude determination (AD) in small satellite. While, controlling the satellite, it shall concentrate both; an effective instantaneous communication and attitude controls method e.g. magnetic actuation (magnetorquers, permanent magnet and reaction wheels). All in all, the paper holds discussion of different types of sensors and actuators that can be used for small satellite missions, following, a future argument has been proposed that can be implemented in (LEO) for the procedures of communication of small satellites (CubeSats).

Keywords: Attitude determination, Attitude controls, CubeSats, Conical Scan Earth sensors, Gyro sensors, Magnetorquers, Magnetic sensors, Magnetic Actuation, Reaction wheels, Sun sensors, Star trackers, Thrusters

Paper ID: ICASE2021-2-ST-13

ICUBE-N: National CubeSat of Pakistan

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The miniaturized version of satellites encouraged cheap access to space at the university level for research purposes. The miniaturization of electronic components and advancements in engineering technologies have paved the way for developing and launching small, low-cost spacecraft. IST initiated the satellite program back in 2010, ICUBE-1 a 1U CubeSat, and was launched in 2013. The second satellite of this program is ICUBE-N, a 3U CubeSat and is in development. The mission's primary goal is to launch ICUBE-N and establish communication with the ground station successfully. The secondary goal is the technology demonstration and data acquisition from different payloads, including a camera. In this work, preliminary design and analysis of different subsystems of ICUBE-N are discussed in detail, along with its required testing and technical support facilities. The presented agile systems engineering approach and components selection will help develop a small budget and educational CubeSats missions.

Keywords: CubeSat, Space Technology, Global Positioning System (GPS), Onboard Computer, Payload, Tracking, tele-command, telemetry (TTC), ADCS

Paper ID: ICASE2021-2-ST-14

Dynamic Analysis of 3U iPOD Structure

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During a rocket launch, satellites withstand large random dynamic forces due to vibrations that are transmitted from the launch vehicle. The iPOD plays a critical role as the interface between

the launch vehicle and CubeSat. The iPOD minimizes potential interactions with the primary payload(s) on a launch vehicle by physically enclosing the CubeSat, and requiring that they be launched in a dormant "off" state. Apart from protecting the CubeSat from dynamic forces during launch, iPOD also facilitates in deploying the satellite in an orbit. Finite element analysis is an important tool to analyze and check the structural integrity of the structural subsystem and its mechanical interfaces. In this study, the deployer for a 3U ICUBE-N is modelled and the finite element analysis has been done to assess the dynamic and static loading on iPOD structure, mainly manufactured of aluminum alloys. The frame of iPOD is inspected for stress concentration areas and modal frequencies, and the improvements in model are suggested, such as to ensure that deployer does not fail during mission.

Keywords: iPOD, Deployer, Finite Element Analysis (FEA), CubeSat, Modal Analysis.

Paper ID: ICASE2021-2-ST-15

Design and Development of a Portable Dish Antenna for SATCOM Man-Pack Terminal

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In this paper, design analysis of a portable dish antenna for Satellite Communication (SATCOM) application has been presented. SATCOM is of great significance as it can provide coverage over entire globe. RF signals in Ku-band are transmitted over longer ranges after reflection by a parabolic dish antenna. These signals are utilized to send and receive information from remote areas where other communication technologies may fail. The high-gain and high-efficiency offered by a parabolic dish antenna make it suitable for SATCOM, Telecommunication, broadcast and reception applications. However, the procurement of a customized parabolic dish antenna is expensive for developing countries. This paper focuses on the development of a low-cost parabolic dish antenna for SATCOM Man-Pack terminal. The design and construction of a parabolic dish antenna used to intercept RF signals from satellite have been

discussed in detail. The proposed design approach offers a number of advantages such as low complexity, high gain and cost-effectiveness. Based on our proposed approach, parabolic dish antenna can be fabricated in a time efficient manner using easily available materials and local resources. The simulation results validate the high-efficiency and high-gain characteristics of our proposed parabolic dish antenna design. A link budget analysis (uplink and downlink) has also been conducted to investigate the atmosphere effects on RF signals propagation in the air. The attenuation factors include atmosphere clouds, gases, rain, noise temperature and beam spreading.

Keywords: Block Up Converter, Intermediate Frequency, Local Oscillator, Low Noise Block, Portable Dish Antenna, Radio Frequency, SATCOM

Paper ID: ICASE2021-2-ST-16

Design and Simulation of Cost-Efficient Reaction Wheel for 1U CubeSat

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Since the inception of CubeSat technology in space industry, it has become much more feasible for an academic institute to invest in this technology for the sake of research and student involvement in space technology. Moreover, rapid progress in CubeSat technology has made them feasible to be used for different scientific research purposes but the cost associated with different subsystem used in the CubeSat are relatively high which limits student researcher to limit their scope. The attitude control mechanism is an important aspect of a satellite, and for this purpose, this research presents the cost-effective development of a reaction wheel alongside with three-reaction wheels actuation model for 1U CubeSat.

In the presented setup, the reaction wheel is developed using a commercial-off-the-shelf (CoTS) component, based upon hard drive disk (HDD). HDD based brushless DC motor and flywheel are utilized for this research. The simulation of the developed reaction wheel for 1U CubeSat is carried out in the Simulink environment using a three-wheel setup and PID based controller with space environment disturbance torques values as initial parameters.

The output of the simulation presented the working and response of the purposed reaction wheel against the disturbance torques. Moreover, the output of the simulation also provided system parameters information such as response time of reaction wheels, maximum angular acceleration, and maximum torque generation. The HDD based reaction wheel with one flywheel has potential to produce maximum torque of 37.6 *mN.m.*s at the angular momentum of 6200 rpm and has power consumption ratings from 0.4 watts to 0.7 watts and an operating temperature of -40o C to 75o C. The final design output confirms the use of HDD based components for reaction wheel development.

Keywords: Reaction wheel; Attitude Control; Disturbance Torques; Brushless DC Motor; 1U CubeSat, Simulink Model

3: Information & Communication Technologies

Paper ID: ICASE2021-3-ICT-3

Comparative Study of Image to Image Translation Models for Abnormal Weather Effects Removal

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Contamination of images by abnormal weather environments such as fog, haze, rain streaks and snowflakes is inevitable as they are naturally occurring weather effects. These weather effects degrade the effectiveness of various machine vision tasks such as aerial and ground navigation, video surveillance. In this paper, we introduce a model based on image to image translation that is Multi-Modal Contextual Conditional Generative Adversarial Network (MC2GAN) for the restoration of weather degraded images, and compare its usefulness with the available image to image translation models namely, Unsupervised Image Translation (UNIT), CycleGAN, Contrastive Unpaired Translation (CUT) and FastCUT qualitatively and quantitatively. Both supervised and unsupervised models are analyzed and we show that the proposed model outpace the alternatives.

Keywords: Visibility improvement, Street views, Smart cities, Weather effects, Supervised and unsupervised image to image translation, Conditional adversarial network, Context encoders.

Paper ID: ICASE2021-3-ICT-5

Pick and Place Hand-Gestured-Robot for Physically Challenged People

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Robots, which are used to pick up an object and transfer it to the desired place, are known as pick and place robots. It can be of any shape and design e.g., a cylindrical robot, spherical, articulate or scara robots providing movement in horizontal, vertical and rotational axes. In this article, development of pick and place robot is discussed. The robot is controlled via NRF communication. The robot comprises of two main parts, robotic vehicle and arm. The robotic vehicle is capable to move in all possible four directions. The movement of the robotic vehicle is controlled by gesture human hand wrest using accelerometer. The movement of the arm is controlled by the gesture of human hand fingers using optical sensors. The controlled movement of robotic arm is such that it can pick and place objects up to weight of 1 kg from any source place to desired destination. The prime aim of the designed robot is to make it feasible for physically challenged people to transfer and get things using hand motion.

Keywords: NRF communication, pick and place robot, accelerometer, optical sensor, hand motion.

Paper ID: ICASE2021-3-ICT-6

Blockchain Based RFID Prototype for Medicine Traceability along the Healthcare Supply Chain

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Healthcare supply chain refers to the process of procurement and distribution of medicines and other healthcare products as they move from the manufacturing plant to the patient. This is a very complex and distributed process that comes with a set of its own challenges like scalability, synchronization and trust between the involved parties. The increase in adoption of Radio-frequency Identification (RFID) based systems in Healthcare supply chain shows that RFID technology is a very promising technique for traceability, identification and communication. However, these RFID systems still face issues of privacy and security which need to be addressed in order to get their full benefit. In this research work, we have integrated RFID systems belonging to the Healthcare supply chain with a secure decentralized storage such as Blockchain. Blockchains provides a secure and transparent decentralized mechanism which is used to keep track of all transactions. It offers a new kind of implementation focused on trust, transparency, and accountability. Information about the RFID enabled medicines and other Healthcare products can be added to our proposed framework via a blockchain-based decentralized application (Dapp). The proposed system is based on an Ethereum node, and this information can be stored in a Blockchain using multi-stage interfaces provided by the Smart Contract. Our proposed system has been deployed both on an offline and online environment, and it offers many advantages like monitoring and tracing of medicine through the Blockchain network, determining if the medicine is genuine or counterfeit, and reducing the number of counterfeit and unapproved medicine entering the Healthcare system. Based on simulation results, the proposed framework successfully provides needed security and privacy required for Healthcare supply chain.

Keywords: Blockchain, RFID, Dapp, smart contract, medicine traceability, medicine records

Paper ID: ICASE2021-3-ICT-7

A Review of Vulnerabilities and Cyber-Security Threats Associated with Overseas Telecom Companies' Operations

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Growing technological advancements in Mobile Telecommunication Companies' connectivity services including GSM, GPRS, 3G, 4G, Wi-Fi, WiMax and Blue-tooth have led them to be a vital component of our daily lives. The companies have enabled their user to perform routine tasks on the go. On the other hand, this rapid advancement in technology, broadened bandwidth along with tremendous usage have made these companies vulnerable to malware and various other associated security breaching attacks ultimately affecting their end users. The vast options of connectivity, device software platforms and telecom services have made these mobile stations critical regarding security and privacy. The current study reviews the possible threats, vulnerabilities of overseas mobile companies operating in Pakistan, attacks and their solutions on both mobile stations and switching centres. Attacks are categorized into old attacks and new attacks. With this categorization, the paper presents an easy and brief view of different attacks and vulnerabilities associated with the telecom industry.

Keywords: Cyber-attack, encryption, passive threat, vulnerability, data security and privacy

Paper ID: ICASE2021-3-ICT-9

Promoting Sustainable Cotton Production through Smart Farm Advisory Based on Remote Sensing and Advancements in Machine Learning & Artificial Intelligence

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The cotton production in Pakistan has declined from 12 million bales in 1991 to 4 million bales in 2020 which has a direct consequence on the country's foreign exchange earnings. More than 60% of Pakistan's exports are associated with the textile sector and 40% of the jobs in the manufacturing sector. The cotton production faced a setback due to climate change resulting in both biotic and abiotic stresses. About 90% of the farmers are small holders and resource poor that lack appropriate mechanisms to understand the challenges of their crop production. They lack timely advice on appropriate application of irrigation, fertilizer application and pests & disease control measures. The blanket use of pesticides has worsened the situation as the pests & diseases have developed resistance. The traditional approaches of visual inspection do not yield enough results to predict the crop health; this resulted in poor crop failure and huge economic loss for the farmers. The crop health status will be predicted by using a combination of data from the remote sensing ground-based sensors and ground truth surveys. The data will be processed using crop models (Decision Support System for Agro technology Transfer (DSSAT) and machine learning by applying artificial neural network tools to devise the optimization of management practices for Cotton crop. The tool will provide a precise local and field level advice to the farmers for optimum use of inputs, their time of application and reduce losses and improve farmer's income.

Keywords: Sustainable cotton production, climate change, pests and disease, input applications, remote sensing, and smart advisory

Paper ID: ICASE2021-3-ICT-10

An In-Data Network Intrusion Detection by Employing Machine Learning Algorithms

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Data privacy and confidentiality are always first priority of data providers. Advanced and smart attacks are increasing day by day and feature filtering based traditional intrusion detection networks are facing problems in the detection of new attacks. In this study, we have focused on the detection of these attacks within the data of model using the NSL-KDD dataset for the analysis of threat detection in machine learning (ML) models. Initially, the dataset is preprocessed and later the feature learning was applied to the numeric values of the data. Output of feature learning technique is applied to different base ML models to compare the performance of selective ML models.

Keywords: Intrusion Detection System, Smart Attacks, Machine Learning, NSL – KDD.

Paper ID: ICASE2021-3-ICT-11

Sentiment Analysis of Social Media Text for Selective World Events and Geographical Segregation

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This research study covers the domain of natural language processing and the use of natural language processing (NLP) to make a filter on social media (in our case Twitter) text which in return can give us a feedback of how a specific topic, entity or scenario is seen or felt by different and huge population. In this document we are trying to apply sentiment analysis on Twitter. Our final model is going to give us amount of positive and negative tweets about a given input that we are interested in, such as, event, topic, entity (which will be referred as an

aspect in this document). We are also going through popular neural networks that have been used till 2018 for sentence classification. This paper is not explanation of all the neural networks architecture such as found in surveys. We are going to share our own thoughts of how we are going to implement Sentiment Analysis based on practical constraints.

Keywords: NLP, Artificial Intelligence, Text Classification

Paper ID: ICASE2021-3-ICT-13

Campus Terrain Surveying and Mapping using Low Range 2D Laser Scanners

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This paper presents a vehicle based custom made urban mobile scanning and mapping system for surveying outdoor environments. The system is equipped with multiple low range 2D Hokuyo laser scanners mounted in different orientations in order to perceive the environment. Additionally, global positioning system, inertial measurement unit and camera have been integrated with the system to record pose and visual information. The system has been tested inside campus and outside region adjacent to campus. Comprehensive and accurate mapping results have been found and presented in the paper. Further analysis on the developed map for assessment of the road furniture like electric poles, vegetation and sign board is possible comfortably. Therefore, the system can be very helpful for concerned public and private entities to do renovation, construction and extension in existing urban structures. Moreover, the system is economical and faster than the available local urban surveying systems with greater efficiency.

Keywords: Mobile mapping, laser scanner, GPS, IMU, Kalman Filter.

Paper ID: ICASE2021-3-ICT-15

Autonomous Drone Navigation Using Deep Convolutional Neural Network

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Drones are unmanned aerial vehicles utilized for a broader range of functions, including delivery, aerial surveillance, traffic and architecture monitoring, and even in War field. Indeed, drones confront significant obstacles while navigating independently in unstable and highly dynamic environments. Therefore, the proposed deep learning-based information-driven strategy for drone navigation may overcome the environmental challenge compared to the standard "map-localize-plan" approaches. For this purpose, a residual learning-based convolutional neural network (CNN) named Modified Residual-DroNet is proposed to pilot a drone across city streets safely. The Modified Residual-DroNet generates two outputs against each input image: a steering angle and probability of a collision. The steering angle controls the drone's movement whilst dodging the hindrances. In contrast, the probability of a collision alerts the Unmanned Aerial Vehicle (UAV) far away from spotting risky situations and responding quickly. The proposed technique is evaluated on the standard Udacity and Collision dataset using the holdout validation technique. The high recall (99.38%), good accuracy (97.78%) and F-score (94.81%) suggest that the proposed technique may be utilized for autonomous driving of drones. Therefore, despite being trained the proposed technique on urban road cars data, the encouraging results of the proposed navigation strategy suggest that the Modified Residual-DroNet have good generalization capability. Moreover, the proposed Modified Residual-DroNet outperforms as compared to previously reported approaches.

Keywords: Residual Network, Drone, Convolutional Neural Network, Perception and Autonomy

4: Positioning, Navigation & Timing

Paper ID: ICASE2021-4-PNT-1

Multi-GNSS Navigation Performance Assessment and Improvement Quantification

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The Global Navigation Satellite Systems (GNSS) offer an easy, efficient, and cost-effective way to determine the location, time, and velocity anywhere around the globe. However, the existing systems have only been successful in outdoor or open-sky environments and often lack consistency in maintaining the required navigation performance (RNP) thresholds in urban contexts where availability and accuracy of GNSS are degraded due to signal blockage, multipath (MP) effects, and NLOS reception. In recent years, GNSS technology has undergone remarkable developments in terms of satellite constellations, signal quality and transmission, receiver technology and positioning estimation techniques. The completion of emerging navigation systems (i.e., BeiDou and Galileo) along with the modernization of existing constellations (i.e., GPS and GLONASS) promises significant improvements in satellite visibility, geometry, quality of navigation signals, and thus overall localization accuracy. The aim of this paper is to record, quantify and compare the performance of satellite-based navigation systems in single and multi-GNSS mode under different operating environments. For this purpose, a series of field experiments are carried out in multi-GNSS and GPS-only mode with total observation period of 24 hours and 864,000 data samples at standard open-sky and degraded site (i.e., surrounded by high-rise buildings). In the multi-GNSS mode, all four global constellations (i.e., GPS, GLONASS, Galileo and BeiDou) are utilized simultaneously for the first time over Pakistan. The performance assessment in this paper is carried out using fundamental quality indicators, e.g., satellite visibility or service availability, satellite geometry in terms of PDOP, and statistical accuracy measures (i.e., Circular Error Probable (CEP) and Distance Root Mean Square (DRMS)). The results of performance assessment indicate that combining multiple satellite constellations

in multi-GNSS mode results in increased satellite visibility/availability, better geometry and thus significantly improved localization accuracy. It is then further analyzed that increased satellite availability in multi-GNSS mode may not result in consequential improvements in positioning accuracy at standard open-sky environment, however, significant improvements were observed at the degraded site. The statistical accuracy of reported positions was found to be improved by five times and outages were reduced by almost 50% of the observation period in the multi-GNSS mode at the degraded site.

Keywords: GNSS, Performance Assessment, Positioning Accuracy, Environmental Contexts

Paper ID: ICASE2021-4-PNT-2

Analysis and Estimation of Zenith Wet Delay and Zenith Tropospheric Total Delay at Earth's Different Geographical Areas

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A comprehensive analysis is performed for the estimation of zenith troposphere delay (ZTD) and zenith wet delay (ZWD) from combined GPS/GLONSS precise point positioning (PPP) method. For this purpose, experiment is conducted from the dataset collected during winter and summer seasons from International GNSS service (IGS) stations at low, equator and high latitude areas. Results demonstrate that ZWD for the stations at higher altitude during winter and summer season is within 0.05 – 0.08 m and 0.14 – 0.17 m, respectively. While, estimates of ZWD for the stations at south region is within 0.12 – 0.15 m and 0.06 – 0.09 m for the winter and summer seasons, respectively. Furthermore, central regions have relative similar ZWD values during two different seasons. ZTD estimates also compare with respect to the corresponding IGS tropospheric delay ground true values. Results demonstrate that ZTD show that stations at the equator has quiet similar trend of the tropospheric delay during two seasons. While, at very high and very low altitude, large variation of tropospheric delay values is obtained.

Keywords: International GNSS Service, Zenith Tropospheric Delay, Precise Point Positioning, Open Source Software)

Paper ID: ICASE2021-4-PNT-3

Parameter Identification and Optimization of Permanent Magnet DC Motor Using Nonlinear Least Square Error Method

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Parameter identification and optimization of any system play an important role in system modeling and subsequent control system design. DC motors are frequently employed in industry for their ease of use and control. Dynamic models of motors based on motor parameters are used to design the control systems. However, for designing sophisticated control systems accurate motor parameter values are required. This paper presents a technique for the identification and optimization of these parameters for any permanent magnet DC motor using the non-linear least square method. Parameters and speed response are measured using experimental readings from data acquisition equipment and exploiting analytical relationships of PMDC motor dynamics. These experimental values are used to optimize nominal motor parameters using the non-linear least square error method. A computer-based algorithm is employed to minimize the error in several iterations based on the non-linear least square error function. The results show that the non-linear least square error method was able to minimize the relative error below the set tolerance which resulted in the close matching of simulated and measured responses of the motor. These optimized motor parameters can be utilized to design a sophisticated control system for various applications.

Keywords: Estimation, nonlinear least square error method, parameter optimization, PMDC motor

Paper ID: ICASE2021-4-PNT-4

Threats to the Navigation of Drone Based Delivery Services

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Drone-based delivery services are expected to have massive commercial deployment in the upcoming years. The potential for drones to deliver goods across different terrains, at an unprecedented speed, has been attracting both investors and customers alike. Medical supplies, pesticides, ammunition, and other variety of goods can be transported more quickly and efficiently by using fixed-wing and rotary-wing unmanned aerial vehicles (UAVs). These delivery drones, however, require a sound navigation system that can guide and navigate them properly from one place to another. Global navigation satellite systems (GNSS) have been playing a vital role in drone-based delivery services as they provide navigation services by employing size, weight, power, and cost efficient hardware. However, satellite-based navigation systems are vulnerable to several threats, which turn drone-based delivery into a complete disaster causing collateral damage to goods and human infrastructure. This paper highlights some of the main threats to the GNSS-based navigation with regards to drone delivery services.

Keywords: Global Navigation Satellite Systems (GNSS), Global Positioning System (GPS), Zipline, Amazon Prime Air, Drone Based Delivery Services, GNSS Jamming, GNSS Spoofing.

Paper ID: ICASE2021-4-PNT-5

GNSS TEC Based Ionospheric Anomalies Related to the 2019 Mw 6.2 Thailand Earthquake

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Detecting seismic ionospheric perturbation by Global Navigation Satellite System (GNSS) is an inevitable approach and has proven to be a new field in the investigation of Earthquake (EQ) precursors. In this paper, the temporal Total Electron Content (TEC) anomalies are investigated from the International GNSS Service (IGS) stations around the epicenter of the November 20, 2019, Thailand EQ (Mw 6.2), that occurred on UTC=23:50:43 h. Seismo ionospheric perturbations are estimated with TEC during thirty-one days (twenty days prior and ten days followed by EQ). The solar and geomagnetic activity indices are checked in the context of EQ. Quiet geomagnetic activity is observed on the day of EQ. However, Kp is larger than 3 immediately after the EQ. Results depict the TEC perturbation measured at three GNSS stations. Furthermore, clear positive anomalies are detected within three days prior to EQ Mw 6.2, (-3, -2, and -1 days) during quiet geomagnetic activities. Since, Kp >3 after the EQ. Therefore, the ionospheric perturbation is related to geomagnetic storms.

Keywords: Ionospheric perturbation, Thailand Earthquake, Total Electron Content.

Paper ID: ICASE2021-4-PNT-6

Investigation of Seismo-Ionospheric Anomalies Associated with the Mw 6.7 Mongolia Earthquake

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The seismo-ionospheric anomalies associated with the Mw 6.7 Mongolia Earthquake (EQ) occurred on Jan 11 ,2021, are investigated from the Global Navigation Satellite System (GNSS) based Total Electron Content (TEC) acquired from the stations in seismic region. To observe the EQ anomalies, it is mandatory to take into account the variations in solar and geomagnetic storm activities, the present study has the worldwide geomagnetic storm level, particularly the Disturbance Storm Time (Dst), Kp, Ap, F 10.7 indices prior to EQ and after the EQ. It is clear that the EQ happened during the quiet geomagnetic conditions Kp < 3. But the storm was active five days before the EQ. The electromagnetic variations within the ionosphere related to EQ are statistically examined in TEC from IGS stations. Our results from TEC clearly show that the ionospheric anomalies are induced several days before the EQ near the epicenter and positive anomalies appear on -4th Day, -3rd Day, -2nd Day, - 1 Day and on main shock day. Based on the obtained results, anomalies in TEC are more likely related to the geomagnetic storm indices due to its abnormality during the EQ preparation period. Furthermore, enhancement and depletion in TEC prior to EQ supports the presence of storm anomalies over the seismic zone.

Keywords: Earthquake, Global Navigation Satellite Systems, Total Electron Content, Geomagnetic Storm

Paper ID: ICASE2021-4-PNT-7

Investigation of Ionospheric Scintillation Using BeiDou during Geomagnetic and Non-Geomagnetic Storm Conditions over Pakistan

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The amplitude and phase of the trans-ionospheric radio frequency (RF) signals can be influenced by the existence of electron density irregularities in the ionosphere. These irregularities may give rise to ionospheric scintillation phenomena which is characterized by rapid amplitude and phase variations in the received signals. The occurrence and severity of ionospheric scintillation is highly dependent on the geomagnetic storm, solar activity, time of the day and geographic location of the receiver and thus, poses a significant threat to the availability and accuracy of satellite-based navigation systems. This paper presents a detailed study on ionospheric scintillation using the Chinese BeiDou navigation system at the verge of low and mid latitude (Sukkur, Pakistan: Latitude 27.73◦ N, Longitude 68.82◦ 8 E). The variations and occurrence patterns of scintillation are studied in detail using BeiDou raw data for the year 2020. The diurnal, monthly, and seasonal variations were investigated during geomagnetic quiet and disturbed days. The results of this study shows that amplitude scintillation is more likely to occur at this region (Pakistan) as compared to phase scintillation. The detailed analysis of scintillation occurrence patterns indicates that scintillation is found to be more active in winter season with maximum scintillation events (S_4> 0.3) in the month of March. This initial study on occurrences of scintillation over Pakistan can be beneficial for better understanding the scintillation trends over Pakistan and can pave the way for conducting long term studies.

Keywords: BeiDou, Ionospheric Scintillation, TEC, Space Weather.

Paper ID: ICASE2021-4-PNT-9

Performance analysis of global ionosphere/TEC models over Islamabad

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GNSS signals are severely affected by the ionosphere layer and accurate assessment of the ionosphere delay is necessary for accurate positioning. In return, the GNSS technology may be used to estimate the total electron content (TEC) parameter in the ionosphere that can provide insight to space weather. Various organizations provide global TEC maps based on empirical data that can be used to assess the local TEC. For regions with no GNSS/GPS stations (such as for Pakistan), the GNSS users must only rely on these international models. Reliability of two such global models: International Reference Ionosphere (IRI)-2016 and Global Ionosphere Maps (GIM) by International GNSS Service (IGS), was assessed over Islamabad region. The local GPS TEC was measured for one month using a dual frequency GPS receiver installed at Islamabad as a reference. Analysis revealed that: (1) GIM overestimates the TEC whereas IRI-2016 underestimates it. In absence of local GNSS data, (2) IRI-2016 correlates better to actual TEC as compared to GIM. It was therefore concluded that in absence of local GPS –TEC, IRI-2016 is a better option to measure TEC at Islamabad.

Keywords: Global Positioning System (GPS), Total Electron Content (TEC), International Reference Ionosphere (IRI), International GNSS Service (IGS)

Paper ID: ICASE2021-4-PNT-10

Investigation of Pre-Seismic Ionospheric and Atmospheric Anomalies before Mw 6.1 El Salvador Earthquake on October 28, 2018

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Seismo-ionospheric anomalies (SIA) from space and ground instruments can provide deep insights over the epicenter of future earthquake (EQ). An earthquake may disrupt the lower as well as upper ionosphere through several coupling mechanisms during the EQ preparation periods. This paper analyzes the temporal variations in Total Electron Content (TEC) from Global Positioning System (GPS), Outgoing Longwave Radiation (OLR), and Air Temperature (AT) from GIOVANNI-AIRS and MODIS, respectively, prior to El Salvador EQ that occurred on October 28, 2018. The temporal TEC observations retrieved from the International GNSS Service (IGS) stations of Managua and Guatemala cities, laying within the earthquake preparation area (EPA), showed a positive ionospheric response from 2 to 3 TECu from the corresponding upper bound about 2-6 days before the EQ. The variations are found based on the confidence interval of median and associated interquartile range for 10 days before and 5 days after the main-shock. The bounds are calculated from continuous analysis of 10 days before and after the observed day. Additionally, sudden increments in atmospheric AT and OLR were also found consistent with ionospheric TEC variations that indicate an EQ induced atmospheric environment. Furthermore, to monitor the space weather conditions during the observation period for the EQ, we examined the solar wind speed (VSW), solar radio flux (F10.7) solar activity, and disturbance storm-time (Dst), Kp geomagnetic activity indices to distinguish SIA. The mutual enhancements in atmospheric and ionospheric parameters might be due to the abrupt energy released by this EQ that exhibits a lithosphere-atmosphere-ionosphere coupling (LAIC).

Keywords: Earthquake, GPS-TEC, Ionosphere, OLR, Space Weather

Paper ID: ICASE2021-4-PNT-11

Positioning Accuracy Performance: Evaluation Using Empirical Data of Multi-GNSS; DGNSS, PPP and RTK through Low Cost GNSS Receiver

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The research work presents performance evaluation of different positioning techniques including Single Point Positioning, Precise Point Positioning and Real Time Kinematics using empirical data and low cost GNSS receiver shall be analyzed. Static and kinematic positioning in real time and through post processing in confined environment with environmental multi-path constraints shall be attempted. The open source software has been used to process the data, along with a base station setup in target area for RTK positioning. Correct positioning files from International GNSS Service (IGS) containing precise satellite orbit and clock errors are incorporated to minimize the error in Precise Point Positioning. For the study a dataset of 3 days from a GNSS receiver placed at Institute of Space Technology, Islamabad has been used. Finally, the standard deviation and convergence time has been calculated for each technique. The considered Global Navigation Satellite Systems (GNSS) are GPS, GLONASS and BeiDou.

Keywords: Real Time Kinematics (RTK), Differential Global Navigation Satellite System (DGNSS), Precise Point Positioning (PPP), Low Cost GNSS Receiver, International GNSS Service (IGS)

Paper ID: ICASE2021-4-PNT-12

Ionospheric Responses to Geomagnetic Storm of June 2015 over the Middle East Region from GNSS TEC and GUVI

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This paper presents the ionospheric response to one of the extreme space weather events that occurred during the solar cycle 24. In this context, the responses of the low latitude ionosphere over the middle East region to an intense geomagnetic storm that occurred around the summer solstice (June 2015) has been investigated. For this purpose, the data of GPS receivers located in the middle East region is used to analyze the storm-time temporal changes of the Total electron content (TEC) under geomagnetically quiet and disturbed conditions. Daily mean value of the GPS-TEC is investigated for each GPS station during the storm. As expected, the ionospheric parameters are largely disturbed by geomagnetic activity. The study shows that the seasons have significant impact on the storm-time response of the low latitude ionosphere. We observed the negative ionospheric response for June 2015 over the selected stations in the middle east region. The global thermospheric composition maps show a storm time variation in the neutral ratio of the O⁄N_2 ratio. Negative storm effects are observed. The observed storm time enhancement in the O/N¬2 is consistent with the TEC behaviour during all these storms.

Keywords: Global Positioning System, Total Electron Content, Thermospheric Composition, Geomagnetic Activity

5: Geographic Information Science

Paper ID: ICASE2021-5-GIS-3

Design and Implementation of Dual-Axis Solar Tracking System for Maximizing the Efficiency of Solar Cells

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Nowadays, with various technological developments, the energy consumption to production ratio is becoming a severe challenge. Though scientists have already made great strides in this area, using both renewable and nonrenewable sources, the latter has a limitation, of not being enough to fulfill the requirements of existing world needs and also has a significant contribution to Global Warming. For that reason, during the past few years the focus has shifted toward renewable sources. One of the vital sources of renewable energy is "Solar Energy". There is a need for developing methods for utilizing solar energy more effectively and productively, by increasing the absorption amount of solar energy. For this purpose, in this research, a dual-axis solar tracking system accompanied by a sensor; that is capable to follow Sun's trajectory by automatically changing its orientation has been designed. An Automatic control system that precisely positions the photovoltaic cell panel according to sun orientation for maximizing the efficiency of the system has been designed and implemented. Solar tracking cells produce energy during the daytime in excess amount than required, so in our design, we modulate a system for storing this additional energy for later use. This system is critically important during the night, and under cloudy conditions or storms, where the sun is not producing the required amount of energy. Our main approach is to develop a cost-effective design of a solar tracking system that will efficiently increase the performance of the system with additional benefit of a tracking system requiring low maintenance cost. Another focus is to develop a design, as simple as possible, because complexities in design may ultimately result in reduced life of the system. In the end, efficiency analysis has been done to check whether a solar tracking system with all its complexities is worth it or not. Detailed analysis of tracking system components i.e. sensors and actuators is presented, which is to help the selection of the most effective design.

Keywords: Solar Energy, Solar Tracking, Automatic Control System, Dual Axis Solar Tracking System, Low maintenance, Cost-effective, Sensors, and Actuators.

Paper ID: ICASE2021-5-GIS-6

Accessibility Analysis of Fire Brigade Vehicles by Using Geospatial Techniques. (A Case Study of Lahore)

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Occurrences of fire incidents is common in Lahore city. Approximately 2500 fire incidents occur annually and take lives of hundreds of people. The number of these incidents have been increasing due to the city expansion, unplanned residential areas, population growth, lack of awareness and basic infrastructure. The Geo-spatial and GIS technology have provided us with new tools that are very efficient in analyzing, investigating, describing, clarifying and visualizing the fire-prone.areas for effective and better management with accessible resources that give accurate results. Our area of investigation is the largest city of the province and second largest city of the country Pakistan. There are 26 working fire brigade vehicles unsystematically distributed in 18 rescue stations of Lahore. This study shows the delineation of unsafe and safe extents that depend upon the existing frames and infrastructures. The result demonstrates that the fire brigade vehicles of Lahore are unable to access one percent of the investigation site, which is about 17 square Kilometers, because of the difference in vehicles' dimensions and road width. Zones of accessibility have also been produced using ArcGIS network analysis, which illustrates that the fire brigade vehicles can only reach, 20% of the area, within 7 minutes that is the internationally accepted incident response time. And 47% of the city is reached after 15 minutes, whereas the vehicles reach 32 percent of the area within 8 to 15 minutes. Analysis of this research exhibits, the unplanned colonies having lesser road widths and lacking basic facilities are inaccessible for the fire vehicles and prone to fire incidents. This investigation further determines that new geospatial technology is efficient and effective that can help in better policy making and improved decision making. Researches like this must be encouraged in developing countries like Pakistan to combat these challenges. This study also recommends that smart fire-vehicles must be introduced with more water capacity and lesser widths so that

more areas become accessible. And more firebrigade vehicles should be built with updated technology, ultimately saving lives and properties of people.

Keywords: Accessibility Analysis, GIS, Geospatial, Network Analysis, Mapping, Zoning

Paper ID: ICASE2021-5-GIS-8

Probabilistic Assessment of Storm Surge Hazard along Coastal Regions of Sindh Province, Pakistan

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A phenomenon that brings about abnormal rise in the sea level is referred as storm surge generated as a result of tropical cyclones. Tropical cyclone are low pressure systems which are often very powerful and intense causing serious damages by producing destructive winds, surges and heavy rainfall. Over the past decades, North Indian Ocean has been subjected to the catastrophe of tropical cyclones leading to massive economic and human losses. The coastal zones of Pakistan, India, Bangladesh, Myanmar, Sri Lanka and Oman are consistently affected by storm surges. Although Arabian Sea is potential region for cyclones, but the frequency of cyclones is occasional and mostly during the monsoon and post monsoon season. A number of tropical cyclones dating back to 100 years have struck Pakistan's coastal areas in the years 1895, 1902, 1907, 1948, 1964, 1985, 1999, 2001, 2007, and 2010. In view of rapid recurrences of cyclones in past few years this study aims to carry out probabilistic assessment of tropical cyclone hazard to estimate the return periods for surge heights for the province of Sindh. The CAPRA ERN-Hurricane model simulate surge heights along the shoreline for provided historic cyclone tracks from IBTrACS v04r00 and employing topography, bathymetry, wind exposure and soil roughness as other input parameters for the model. Furthermore, the frequency analysis by Gumbel method has been adopted in the study to estimate surge heights for 25, 100 and 500 years return periods. ERN Hurricane model estimates highest surge value of 0.6385 m for tropical cyclone 02A 1999. Second highest surge value in historic cyclone is 0.6067 m, which corresponds to tropical cyclone Phet 2010. While frequency analysis estimates maximum surge value of 0.5905 m, 0.7352 m, 0.9041 m for 25, 100 and 500 year return periods respectively. Storm surge hazard data is utilized in making hazard maps illustrating the intensities and inundation

of cyclone over return periods. The data and maps from this study can contribute in planning and developing suitable strategies to mitigate loss for areas at potential risk.

Keywords: Tropical Cyclone, Storm Surge, Disaster Management

Paper ID: ICASE2021-5-GIS-9

Developing Heat Index for Heat Wave Hazard Mapping: A Case Study of Sindh Province, Pakistan

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In the last decade, climate change is prominently seen with rise in occurrence and severity of heat waves, especially in the province of Sindh, Pakistan. Heat waves have claimed thousands of lives and have resulted in major financial losses over the past years. The disaster is a combination of environmental mismanagement and meteorological disturbances. With an increase in frequency of heat wave events recorded in last five years, it is imminent that more losses are expected to occur. It is integral to develop heat wave identification techniques, monitor occurrence events, develop probabilistic models, and formulate risk reduction plans accordingly. This paper is an attempt to map occurrences and assess the impact severity of heat waves in the province of Sindh. Satellite derived daily temperature and humidity records are used to develop a historic database as input in the model. Moreover, it aims at defining a threshold to develop a Heat Index for the region. The index is to be used for defining the discomfort level experienced by people at different heat wave intensities. The study incorporates this heat index to map heat wave hazard, over period from 2000-2019. Several heat wave records are obtained through the algorithm and combined to develop a heat wave hazard map. The study would be beneficial for disaster management agencies and planning departments in coping with the future heat wave hazards and risk reduction.

Keywords: Heat Wave, Satellite Image, Heat Index, Disaster Management

Paper ID: ICASE2021-5-GIS-10

Targeting Mineral Resources by Using Remote Sensing Techniques and Field Data in District Lower Dir, Northwest Khyber Pakhtunkhwa, Pakistan

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The Dir area, Northwest Khyber Pakhtunkhwa, Pakistan, is located at a prospective copper mineralized zone associated with Diorite. In order to delineate the zones of alteration and mineralization features of the rocks, Landsat-7, Landsat-8 and Sentinel-2B data of the investigated area were utilized.

Principal component analyses of the Landsat-7, Landsat-8 and Sentinel-2B images were executed. This directed to the demarcation of separate alteration zones. The principal component analysis-based Crosta technique were used to differentiate alteration minerals. Mapped zones of alteration match well the identified copper mineralization. Field confirmation directed to the detection of alteration zones in the area. The results display that the principal component analysis techniques showed to be helpful in remote sensing data processing with medium to high spatial resolutions. It is determined that the PCA techniques are beneficial for mineral exploration within the vegetated regions of Northwest Khyber Pakhtunkhwa.

Keywords: Landsat-7, Landsat-8, Sentinel-2B, Principal component analyses, Alteration zones

Paper ID: ICASE2021-5-GIS-12

Uplifting Agriculture through ICT and Geospatial Applications: A Review of Potential Tools and Techniques

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In Pakistan, agriculture is the backbone of country's economy and largest contributor in the GDP, i.e. 19.2%, providing employment to a large chunk of labor force, as around 70% of population depends on agriculture for its livelihood. Therefore, the role of the agriculture is indispensable to the wellbeing of the nation, poverty alleviation, employment generation, and food security. Large-scale population and labor shift from rural to urban areas along-with other constraints including shrinking of arable land due to horizontal urban advancement, water shortage and climate change have resulted in shrinking agricultural growth. Innovations and involvement of latest technologies in agriculture is the need of hour to increase the agricultural productivity. Agricultural data collection by using Remote Sensing (RS) techniques is an efficient method. Radar imagery and satellite based optical technology can be used for data acquisition, analysis, monitoring, and mapping. Various factors can be studied with greater accuracy through digital image processing (supervised or un-supervised classification, image enhancement, and spectral slicing). Similarly, in-situ observations can be integrated using ICT based tools to different geospatial and crop models for flood monitoring, drought assessment, crop production forecast, and estimation of crop water requirement and acreage under different crops. These advances may prove to be the foundations for the future research establishment and uplift of the agriculture in Pakistan.

Keywords: GIS and RS, ICT, digital agriculture, hazards mitigation.

Paper ID: ICASE2021-5-GIS-13

Atmospheric Monitoring Using Artificial Intelligence Models & Applications

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In this paper we discuss Artificial intelligence and the role it plays in atmospheric monitoring though the use of different models and sensors. With the discovery of greenhouse gases and global warming atmospheric monitoring has become an essential requirement. With the help of Artificial intelligence, we can fulfill that requirement. AI tools revolutionize the monitoring process through accurate data gathering and forecast information. In the use of AI there are risks and negative effects but its applications are vast. AI can help in Atmospheric monitoring through its integration in machine and sensors. PSO-SVM model (The Support Vector Machine (SVM) would be a methodology for categorizing data that could be split linearly that uses fundamental classification concepts) and MODIS model (This Moderate Resolution Image Spectroradiometer (MODIS) is indeed a payloads imaging sensor. The movement of aerosol-borne contaminants could now be tracked overland, Atmosphere and ocean surfaces thanks to NASA's Moderate-resolution Imaging Spectroradiometer) were discussed in this project.

Keywords: Atmospheric Monitoring, AI Models, Air Quality, Artificial Intelligence

Paper ID: ICASE2021-5-GIS-14

Improving Polio Vaccination Exposure in Pakistan Using Geospatial Analysis

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Poliomyelitis (Polio) is a disabling disorder caused by a virus that damages the human brain. People without signs of polio and people ill with poliovirus can silently spread the virus. This research aims to analyze poliovirus health care data across Pakistan by implementing a framework that identifies and creates clusters of settlements, targeted population, and management of vaccination teams allocated to the desired area. The decision-makers and vaccination campaign person can then use these analyses on Geographical Information Systems (GIS) maps to manage all settlement locations in the targeted districts. GIS is useful for epidemiological studies, and the part of GIS has better significance due to its ability to integrate data sources and to make difficult data understandable. This research will identify the hotspot district in Pakistan and then study the variables triggering delays in polio vaccination coverage in Balochistan districts. The polio cases' actual ratio can be calculated using spatiotemporal and statistical data using geospatial tools and software. The purpose of this research is to use Spatio-temporal analysis to prevent the poliovirus spread all over Pakistan. This research will facilitate the management of polio vaccination campaigns planning that aims to reach all children across Pakistan and seek to transform poliovirus data into information necessary for strategic planning.

Keywords: Geospatial, Polio, Temporal Analysis, Interpolation, GIS.

Paper ID: ICASE2021-5-GIS-15

Geospatial Application of Groundwater Quality Index for Lahore Metropolitan, Pakistan: A Retrospective Approach

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Groundwater quality is significant to be appraised as it is the primary source used for drinking and domestic purpose in Pakistan. Rapid population growth and unplanned urbanization have made water quality a severe health risk in Lahore District Punjab, Pakistan. Satellite Remote Sensing abilities and GIS techniques are powerful tools for collecting and analyzing spatial data related to groundwater sources. This paper presents spatial interpolation techniques to produce water quality data of Lahore, Pakistan. The approaches, which included Inverse Distance Weightage (IDW) and Spline, were compared and evaluated using data from 512 wells. The maps are compared with the World Health Organization (WHO) and Pakistan Environmental Protection Agency (EPA) guidelines. The results indicate that people are at risk of being affected by hazardous concentrations of physical and chemical parameters, including (pH, turbidity, TDS, Ca, Mg, Fe, Alkalinity, NO2, CO3, HCO3, E. coli). High-risk zones are identified, and the potential magnitude of this health threat in Lahore is highlighted spatially in the affected areas. The projections of potential water quality are essential for sustainable water resource planning and management. Numerous groundwater wells remain to be tested to determine the magnitude of the problem due to the sheer size of the Lahore district and its dependents. This study described the geospatial distribution, adopting statistical methods with GIS to characteristics, and mapped the groundwater quality in the different hydrogeological zones. It reveals that several groundwater samples are not suitable for drinking purposes, particularly southwestern Lahore has more contamination due to the higher urbanization rate.

Keywords: Water Quality, Spatial Analysis, Geographic Information System (GIS), Urbanization, Interpolation, Risk Assessment

6: Remote Sensing & Photogrammetry

Paper ID: ICASE2021-6-RSP-1

Unsupervised Classification of Hyperspectral Images Using PCA and K-Means

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The visualization of hyperspectral images in display devices, having RGB colour composition channels is quite difficult due to the high dimensionality of these images. Thus, principal component analysis has been used as a dimensionality reduction algorithm to reduce information loss, by creating uncorrelated features. To classify regions in the hyperspectral images, K-means clustering has been used to form clusters/regions. These two algorithms have been implemented on the three datasets imaged by AVIRIS and ROSIS sensors.

Keywords: Hyperspectral image, HSI, PCA, K-means clustering, unsupervised, classification, bands, satellite, ROSIS, AVIRIS

Paper ID: ICASE2021-6-RSP-2

Machine Learning Based Thermal Anomaly Detection Associated with Three Earthquakes in Pakistan Using MODIS LST

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The monitoring of thermal anomalies from remote sensing instruments may offer some understanding about the precursors of future earthquake (EQ). In this paper, we study thermal anomaly associated with the three EQs (2019 Azad Kashmir, 2013 Awaran and 2017 Khuzdar) in Pakistan from Moderate Resolution Imaging Spectrodiameter (MODIS) within the seismic preparation period. The temporal data of Land Surface Temperature (LST) is considered for 20 days before and 10 days after the main shock day. The temperature measurement showed anomalous values within 10 days before the EQ and 10 days after the EQ. Moreover, the data is also analyzed using neural network for validating the statistically observed anomalies.

Keywords: Pakistan EQs; MODIS; Remote Sensing; Thermal Anomalies; NARX

Paper ID: ICASE2021-6-RSP-3

Performance Evaluation of IRI Models over Mid Latitude during Ascending Phase of Solar Cycle 25

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This study presents the performance of the International Reference Ionosphere (IRI) models for evaluating the Vertical Total Electron Content (VTEC) variations in the mid-latitudinal region of Pakistan (i.e., Sukkur) during ascending phase of solar cycle-25. The temporal comparison of VTEC retrieved from measurement and models is analyzed at the mid-latitude region of

Pakistan during 2020. The results showed minimum deviation during January-February for IRI-2016 and higher deviations are recorded in IRI-2007 and IRI-2012. VTEC values attained by IRI-2007 and IRI-2012 overestimated the GPS-VTEC throughout the year except quiet activity month (May) and solar active (September) month. It underestimated the GPS-VTEC. However, IRI-2016 showed good correlation of 0.79 with GPS-VTEC and it is a fine climate model which offered accurate approximations of ionospheric delays of propagated radio signals. Nevertheless, none of the model was completely able to provide VTEC estimation in solar disturbed days.

Keywords: GPS TEC, IRI models, VTEC, Sukkur, Mid latitude Ionosphere

Paper ID: ICASE2021-6-RSP-4

Using Optical Remote Sensing and Radar Altimeter Data for Lake Volume Estimation of Manchar Lake, Pakistan

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Lakes are a chief source of fresh water. Variation in water volume in lakes provide crucial information about climatic changes and water resources for sustainable water management practices. Continuous monitoring of lake water resources is required particularly with regards to the growing challenges for water resource management. For that purpose, satellite based optical remote sensing imagery and radar altimetry data can be combined for the monitoring the volume of inland water bodies. Optical remote sensing provides information about the area extent of inland water bodies, and the variations in water surface height can be extracted from radar altimetry data. The study area for this research study is Manchar Lake, which is one of the largest sources of fresh water in Pakistan. Time series data of Sentinel-2 are analyzed to calculate water surface area extent using Normalized Difference Water Index (NDWI), and in parallel Sentinel-3 altimetry data for measurements of water surface height was used. Through linear interpolation, identical dates were set up for area extent data to the surface height data. Furthermore, regression analysis was used to develop a relationship between water surface height and water surface area. In this way Heron's formula to calculate the volume of a pyramidal frustum was used by sorting radar altimetry data in ascending order and the corresponding optical remote sensing data to estimate the volume variations of the lake. The analysis of the

results shows also the seasonal and yearly variation in area extent of inland water bodies and water level anomaly.

Keywords: Manchar Lake, Radar altimetry, Normalized Difference Water Index (NDWI)

Paper ID: ICASE2021-6-RSP-5

Implementation of the Maximum Cross Correlation (MCC) Method in Python for Ocean Current Estimation over the Arabian Sea

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Ocean currents are an important parameter in physical oceanography because they act to neutralize the temperature difference between different areas in the oceans. These parameters are important for reduction of shipping cost, and also the dispersal of many life forms also depends on them. The Arabian Sea switches direction annually due to strong monsoon winds and results in changing rainfall patterns seasonally. A few studies have mapped ocean currents in the Arabian Sea using radar altimetry data, however these methods generate only geostrophic currents, have low resolution, and also cannot function well near the coasts. A relatively higher resolution total ocean currents measurement from satellites does not exist for the Arabian Sea over a long time-series. The Maximum Cross-Correlation (MCC) method has been used with Advanced Very High Resolution Radiometer (AVHRR) data in various studies to extract currents in different regions of world. For this study, we have implemented the MCC method in Python with the aim of utilizing AVHRR optical remote sensing image sequential pairs over the Arabian Sea for ocean current generation. The AVHRR level-1B images are first corrected for brightness temperature and then re-projected, to be ready for ingestion in the MCC algorithm, which is implemented in Python as a combination of different functions on pair of images to extract ocean currents. Results represent the velocity vector of ocean currents in the study area. The estimated velocity vectors are then masked with a threshold for the correlation factor and filtered for removal of outliers, for the generation of the final ocean currents map.

Keywords: Advanced Very High Resolution Radiometer (AVHRR), Arabian Sea, Brightness Temperature, Maximum Cross Correlation (MCC) Method, Ocean Currents.

Paper ID: ICASE2021-6-RSP-6

UAV Assessment of Crop Evapo-Transpiration Dynamics in Winter Wheat and Barley under Varying Pressures of Fungal Diseases

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Early detection of the onset of disease in crops allows for more timely and more effective management. Often it is too late to treat diseases once the clinical symptoms are visible to the human eye. To this end, there is great potential to use sensors operating in the infra-red and thermal bands (outside our visible range) to detect diseases before they become visible. Vegetative indices based on near-infrared reflectance responses are often used for this. However, vigor is a delayed response to plant function. The rate of transpiration is a more immediate indicator of plant function and health. Estimations of daily ET rates from thermal satellite imagery have been shown in several studies. The general process-based physical surface energy balance (SEBS) method used was adapted and applied for the first time to Unmanned Aerial Vehicle (UAV) collected thermal and RGB imagery using off-the-shelf low cost camera. On-site COSMOS-UK weather station data were used for meteorological inputs. The ILWIS2 Surface Energy Balance System (SEBS) was used for the daily ET modeling. The daily wheat and barley ET measurements for early May and June 2015 were similar to values obtained from Landsat imagery over nearby cereal fields and closer to the Penman-Monteith calculations for the survey days. This indicates promising transformation from satellite to UAV imagery for estimating ET. Varied spatial patterns were visible in the imagery corresponding to environmental (soil), variety and treatment (fungicide) differences. Barley exhibited little disease pressure at any stage of the season. Disease pressure was not visible at mid-late season (early May) in wheat, but susceptible varieties had visible late season rust infections. ET was a better discriminator of non-visible infections in May than NDVI. Further, studies are required to further validate this proof of concept.

Keywords: Evapo-transpiration, UAV, Wheat, Barley, Fungal Diseases, SEBS, Energy Balance)

Paper ID: ICASE2021-6-RSP-7

Deep Learning Based Radar Target Classification Using Micro-Doppler Features

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Demand for radar automatic target recognition is ever increasing owing to the extensive employment of radar sensors in urban scenarios and a drastic increase in the number of radar targets, especially drones and UAVs. Micro-Doppler signatures, resulting from the micro-motion dynamics of targets, have emerged as a key distinctive feature for radar automatic target recognition. This paper addresses the problem of radar target recognition based on deep learning and micro-Doppler signatures of targets. The choice of MobileNetV2 deep Convolutional Neural Network based classification on spectrogram images of the targets, has made the system more suitable for system implementation on embedded devices such as Raspberry Pi. Second important contribution of this paper is the augmentation of an extensive and diverse training dataset having five classes ultimately, for the testing of radar automatic target recognition, since few such datasets are available in the open literature. The dataset is developed using a W-band Frequency Modulated Continuous Wave radar. After training the model on the diverse training dataset, validation and test accuracies of 98.67% and 99% respectively, are achieved.

Keywords: Radar, micro-Doppler, target recognition, deep convolutional neural network, deep learning, statistical classification

Paper ID: ICASE2021-6-RSP-8

Deep Learning on High Spatial and Temporal Cadence Satellite Imagery for Field Boundary Delineation

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The study investigated the potential of deep learning for the delineation of agriculture field boundaries on PlanetScope and Sentinel-2 imagery. Agriculture field boundary information is vital in crop health monitoring, food security efforts, and precision agriculture. In most developing countries, field parcel information is not available whereas countries like Denmark and the Netherlands regularly provide the updated parcel layers.

Denmark field boundary data for year 2018 was selected for the training of the model. Satellite imagery of four dates (20th April, 15th May, 27th July, and 10th October) was downloaded and preprocessed to capture the crop dynamics on the ground. Semantic segmentation architectures were used to train the models on the imagery, and the results were assessed using metrics such as Intersection over Union(IoU) and f1-scores.

The results show that U-Net architecture with senet154 backbone performs better than other architecture-backbone combinations. In terms of dates of imagery, data from 27th July achieved a higher IoU score. The method of providing input mask to the model had the most impact on the metrics and resulted in a 35% increase in IoU. Temporal stacking of multi-date satellite imagery proved to be an effective way of increasing information content for boundary delineation and improved the IoU by 6.5% in comparison to a single-date model. The final temporal stacked model had an IoU score of around 0.72.

The trained model was able to delineate boundaries and showed good results in comparison to the available ground truth. The model was able to identify agriculture from non-agriculture areas accurately. It also delineated boundaries when provided with the context of inner field areas in a three-class segmentation. Interpretability of initial convolutions added on top of the model indicates that the model initially retains spectral information from vegetation. The results of transfer learning to new areas suggest that there is potential in using such techniques, but further factors need to be considered to improve the metrics.

Keywords: Fields, Agriculture, Deep Learning, Artificial Intelligence

Paper ID: ICASE2021-6-RSP-9

Landslide Hazard Assessment and Monitoring in Azad Kashmir Using Sentinel-1 InSAR Data

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Landslides are frequent pervasive geological hazards that pose a serious threat to people, infrastructure, and the natural environment in mountainous regions with steep slopes. Azad Kashmir lies in the Western Himalayan range and is characterized as a subtropical highland climatic zone. Varying mountainous terrain slopes, relief, and heavy rainfall during the monsoon season cause frequent landslides and interrupt human activities, damage roads, and cause displaced buildings, and houses. In such steep topographic areas with vulnerable conditions, continuous geodetic landslides measurement is an important task for risk assessment. Differential Synthetic Aperture Radar Interferometry (D-InSAR) is a useful InSAR technique for detection, analysis, and monitoring of slow-moving landslides. Differential InSAR measures line of sight (LOS) displacement by exploiting phase information and compute a phase difference. In this study, single look complex (SLC) SAR imagery from Sentinel-1 C-band sensor product has been used to evaluate landslides over Azad Kashmir region. Both ascending and descending pass image pairs were used to generate interferograms for the period of October 2014 to November 2015. Ascending and descending pairs were processed separately in European Space Agency Sentinel Application Platform (ESA SNAP). Displacement values of highly unstable areas that keep high coherence over a period are calculated. Low-coherence areas and decorrelating land-cover types such as agriculture and dense forest are removed from the analysis. Results are then displayed in the form of displacement maps showing unstable areas that may be at risk for further landslides.

Keywords: Interferometric Synthetic Aperture Radar (InSAR), Landslide

Paper ID: ICASE2021-6-RSP-10

Detection of Thermal Fronts in the Arabian Sea through SAR (Synthetic Aperture Radar) Imagery

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During the summer (southwest) monsoon (SWM), the Arabian Sea's surface circulation is clockwise, and heavy upwelling happens along the coasts of Oman and Somalia, resulting in high chlorophyll productivity which forms a thin biogenic slick over the sea surface. Satellite remote sensing observations of these features through optical and infrared wavelengths are confined to low resolution, and are observed to have data gaps due to cloud cover and dust storms. Space-borne Synthetic Aperture Radar (SAR) offers nearly all-weather day-night observation capabilities at a higher resolution. In this study, Advanced Land Observation Satellite (ALOS)-1/2 Phased Array L-band Synthetic Aperture Radar (PALSAR) datasets are used for the detection and extraction of physical oceanographic features of temperature fronts in the Arabian Sea during Southwest monsoon season (SWM). More than 100 HH-polarized ALOS PALSAR 1/2 images for the years 2007, 2010, 2014, and 2015 were acquired from JAXA during Southwest monsoon season. These datasets were pre-processed and Canny edge detection was implemented to extract temperature frontal features. For further analysis of the results, three length scales for the fronts are chosen by selecting length threshold according to the ocean dynamics of the study area. Smaller values of threshold are selected because fronts of smaller length are generally formed in the Arabian Sea during southwest monsoon (SWM) season. The detected fronts in a few cases are then validated against MODIS SST imagery. Validation shows that fronts of greater length are validated but some fronts of smaller length are not validated because of unavailability of data at their corresponding locations and also due to low spatial resolution of SST images.

Keywords: Synthetic Aperture Radar (SAR), Thermal fronts

Paper ID: ICASE2021-6-RSP-11

Modeling & Simulation of BSAR (Bi Static Synthetic Aperture Radar) System Using Reflected BeiDou B1i Signals

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The BeiDou Navigation Satellite System is the recent addition in the GNSS (Global Navigation Satellite Signals) community. Direct BeiDou signals are used for navigation and positioning purposes. This research endeavor intends to utilize the reflected signals as they can provide an opportunity for passive radar applications. The BeiDou satellites, a modified BeiDou receiver and its signal detection components (antennas) form a bi-static radar system. The Bi-static radar (BSAR) can be utilized for passive detection of targets and /or any movement or changes. Firstly, power budget analysis will be calculated for BeiDou B1i signals and compared with GPS L1 signals. Later the whole Bi-static Radar scenario will be simulated as closely and faithfully as possible and a matched filter technique will be used to improve the image resolution. The simulation will be carried out under different conditions and in a detailed manner, and efforts will be made to validate that BeiDou signals can be used as an illuminator or "transmitter of opportunity" for passive BSAR applications with acceptable image resolution.

Keywords: Power budget analysis, Bi-static Radar, BeiDou B1i signal,

Paper ID: ICASE2021-6-RSP-12

Flood Mapping and Crop Damage Assessment using Sentinel-1 SAR GRD and Optical Data through Google Earth Engine

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This study deals with the flood mapping and crop damage assessment for the District of Mirpur Khas, Sindh using microwave Synthetic Aperture Radar (SAR) and optical satellite remote sensing datasets. Floods are one of the most disastrous events across the world and their impact needs to be evaluated and analyzed timely to alleviate and manage the associated damages. The main objective of this study is to delineate the flood extent and assessment of associated damaged crop for the flood that occurred due to monsoon season from August to September 2020 using SAR-based imagery provided by ESA Sentinel-1 satellites and Moderate Resolution Imaging Spectroradiometer (MODIS) global landcover data on a cloud-based Remote Sensing and Digital Image processing platform i.e., Google Earth Engine (GEE). SAR imagery is a more appropriate choice than optical for flood mapping because it has low dependency on weather conditions and can provide day/night images in the situation of emergency because it is independent of solar illumination. MODIS data can be used for crop damage assessment because it gives the global landcover data with a temporal resolution of 1 day. SAR data in VH-polarization and Otsu thresholding provide reliable results for flood mapping.

Keywords: Flood Mapping, Flood Extent, Damage Assessment, SAR, GEE (Google Earth Engine)

Paper ID: ICASE2021-6-RSP-13

Hyperspectral Image Classification Using Unsupervised Learning Algorithms

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Scope of Hyperspectral images (HSI) has extensively increased with development in remote sensing technology. These images have high spatial resolving power for fine spectra which helps us analyze diversified land. In the last two decades, numerous algorithms for the classification of hyperspectral data have been proposed. These algorithms cover unsupervised, semisupervised and supervised techniques. Each proposed algorithm has its own benefits and limitations. In this research, we review unsupervised classification methods using three different types of algorithms that are K-Means, Spectral Matching, and Abundance Mapping. The center objective of this study is to assess the performance of all three classifiers and to observe their applicability on different datasets i-e Cuprite, Pavia center, Moffett Field and Pavia University. This study also covers spectral feature extraction for hyperspectral datasets.

Keywords: Hyperspectral Images, Classification, K means, Spectral Matching, Abundance Estimation

7: Environment & Climate Science

Paper ID: ICASE2021-7-ECS-1

Climate Change an Emerging Risk: A Case Study of Sutlej River Basin, Pakistan

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Fresh water is of prime importance for life and plays key role in the water-food-energy nexus. The rapid increase in population is putting pressure on available water resources of the country. The management of these water resources for the future generations is needed. In this study Sutlej River flow has been simulated and analyzed at Islam Headwork's. The Sutlej River originates from glaciers of western Himalayas in Tibet (China) and is considered as one among prime sources of fresh water supply for Pakistan. After Calibration (1980-1994) and validation (1995-2005), Soil and Water Assessment Tool (SWAT) is used to simulate and analyze Sutlej River flow. Results highlighted that mean monthly discharge flow would seem to decrease in summers for near (2011-2040), mid (2041-2070) and far (2071-2099) future time period with reference to historical (1976-2005) flows. Whereas average monthly flow during winter and spring seasons were projected to increase relative to reference period flow especially for emission scenario 8.5. This Study can help water managers in describing the impacts changing climate on hydrology of Sutlej River Basin which is highly sensitive and exposed to climate change effects.

Keywords: Climate Models,Flood Frequency, SWAT Model, Headworks, Scenario Analysis

Paper ID: ICASE2021-7-ECS-3

Prototype of an Autonomous Farming Robot: A Smart Farming System

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The automated household products in recent technology are adding day by day, we have proposed an autonomous CNC farming project that works on a microcontroller-based Cartesian coordinate system. We present you a Farming Robot that is designed similar to the 3D printer or milling machine in shape and similar precise to perform operation that includes irrigation, seeding, weeding and monitoring soil moisture. This paper briefly describes our project that will assist farmers in monitoring and controlling various activities of farming via Arduino and other components. The status of agricultural parameters is notified to the farmer, allowing him to make appropriate decisions on time. The major benefit of this system is that it is semi-automated, meaning that the farmer makes the choice rather than a completely automated system that results in precision agriculture. It also gets around existing traditional procedures that demand a lot of money, energy, labor, and time. As it's the demand of the environment to have such a product that can grow healthier food in this gradually variant environment and climate change.

Keywords: Computer numerical control (CNC), farming, bot

Paper ID: ICASE2021-7-ECS-4

Design and CFD Analysis of Outer Aerodynamics of 10kw Horizontal-Axis Wind Turbine

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In recent years, wind power has been widely recognized and used as one of the most promising renewable energy sources. Pakistan has a very good wind potential, especially in the provinces of Sindh and Baluchistan. In the current research study, a 10,000-watt horizontal axis wind turbine (HAWT) is designed for the Taftan, Baluchistan region to meet the energy requirements of Pakistan. The Blade Element Momentum (BEM) method is utilized to design the HAWT blade profile while computational fluid dynamics (CFD) analysis is conducted to evaluate the designed profile.

Keywords: Aerodynamics, Wind turbine, TSR, Warlock, CFD analysis

Paper ID: ICASE2021-7-ECS-6

Time Series Analysis of Bindi Dheraja Riverine Forest of Sukkur, Sindh, Pakistan Using Remote Sensing

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Regional forest cover change detection due to anthropogenic and natural factors is critical. It is essential to estimate and to detect the forest cover, and other land-use (LU) changes for

sustainable management. Satellite based remote sensing (RS) perform a significant role in real-time mapping, planning, and monitoring of forest resources. Using multitemporal Landsat satellite images, this study evaluated the forest and other LU cover changes along the river bank of Indus, Bindi Dheraja Sukkur, in southern Pakistan. Multitemporal Landsat images of the years 2008, 2012, 2014, and 2017, were obtained and classified into a forest and another land cover (LC) types. Furthermore, forest cover, and other LU change detection map was prepared from the final maps of 2008, and 2017. The final maps were verified through systematic ground sample points, and high-resolution Google Earth imagery. The results highlighted that from 2008 to 2017, the forest land reduced by 17.18 % with an annual decreased rate of 1.72 %, while agriculture land increased by 26.4 % with an annual increase rate of 2.6 %. The area of water bodies, as well as barren land decreased by 4.84%, and 4.81% with an annual decline rate of 0.48%. These results will be beneficial for continues planning, and monitoring of the forest resources of the region, and could be used by the locals, provincial, and national forest department in the context of sustainable forest management.

Keywords: Remote Sensing, Riverain forest, Land-use Cover Changes, Landsat satellite images.

Paper ID: ICASE2021-7-ECS-7

Investigations of Mechanical Properties of Sn-3.5Ag-0.5La Lead-Free Solder Alloy for Green Electronics

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Eutectic Tin-Lead solder, commonly 63Sn-37Pb, has been used for times in the electronic industry. However, due to the harmful effects of lead on the environment, many alternatives have been investigated. The Tin-Silver alloys are acknowledged on a large scale as a replacement over traditional Tin-Lead solders due to their excellent mechanical properties. However, to further enhance the properties of Tin-Silver alloys, doping of additional elements is highly acknowledged. In this study, the investigation on the mechanical properties of Sn-3.5Ag solder alloy is carried out after doping 0.5 wt% Lanthanum. The yield strength, ultimate tensile strength, creep behavior and hardness are evaluated using tensile tests, creep tests and Brinell hardness

measurement, respectively. The composition of alloys is confirmed using energy dispersive spectroscopy, and phase analysis is done by X-ray diffraction. The results showed a significant increase in all mechanical properties after the addition of Lanthanum into Tin-Silver alloy.

Keywords: Tin-Silver solder alloy, Lanthanum, Phase analyses, Mechanical properties

Paper ID: ICASE2021-7-ECS-9

Autonomous Unmanned Aerial Vehicle for Agricultural, Security, Emergency and Other Uses

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This research revolves around exploration of possibilities of using technology to solve some major problems, with minimum capital and immediate results. These problems include, but are not limited to, Security, Health Emergencies, Agricultural limitations, Cutting down of Trees and Lack of Mobility in hard-access regions. The primary focus was laid on mobility and on an all-in-one solution. In this regard, the use of Unmanned Aerial Vehicles (UAVs), also known as Drones was investigated. It was observed that a Multi-Purpose Drone, designed and built upon a Modular Platform, can prove to be an innovative solution to the problems mentioned above. A drone can access areas which might never be possible to access on foot otherwise, and it can infiltrate hostile regions with no threat of loss of life. Essentially, a drone can be an eye in the sky and prove crucial in many different scenarios. Building upon this idea further, our team explored the possibilities of this. As discussed above, the platform must be modular. That is, the aircraft is to have different swappable modules which can be conveniently swapped-on or swapped-off, depending on the required use on a given instance.

Keywords: UAV, Drone, Autonomous, Aerial, Security, Surveillance, Patrolling, Facial Recognition, Agriculture, Forestry, Tree Plantation, Reforestation, Seed Plantation, Emergency

Response, Payload, Remote Controlled

Paper ID: ICASE2021-7-ECS-10

Dynamics of Shisper Glacier Surge- Upper Hunza, Gilgit-Baltistan Using Geospatial Techniques

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The phenomenon of surging has been observed in Shisper Glacier for many years. This surging has resulted in the formation of an ice-dammed lake. This lake has created a risk of glacial lake outburst flood (GLOF) in the region. Remote sensing and GIS techniques have been utilized in this study. Some more analysis such as morphometric analysis, land cover change, and temporal analysis has also been done. The glacial lake was not seen till July 2018 but it was observed in November 2018. A physical vulnerability has also been examined in this study. Spectral indices such as NDSI, NDWI, and NDGI has also been used in this study for the analysis purpose. Results show that snow and the clean glacier have increased. We suggest in the light of our research that necessary steps should be taken to avoid possible hazardous events that can be caused by the surging of Shisper Glacier.

Keywords: Surging, GLOF, Remote sensing, Glacier, Ice-dammed lake.

8: Applied Physics and Mathematics

Paper ID: ICASE2021-8-APM-1

Innovative Aerodynamic Design of Passenger Car for Low Power Consumption

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In this research, we intend to provide an innovative and ingenious aerodynamic design for a fuel-efficient passenger car that consumes low power and provides greater efficiency and performance. Fuel used by cars mostly is petrol, diesel, and electricity etc. Almost 80 % of the world's cars and automobiles are running on fuel obtained from natural resources. According to research, natural resources are depleting at a very high pace and by the year 2050, we may run out of natural fuels altogether. To reduce the usage of fuel, the efficiency of a car can be increased by improving the design of the car. When we talk about passenger car aerodynamics, drag is a critical factor that cannot be ignored, which is a significant component contributing to the consumption of fuel. Drag is a force that acts in the opposite to the direction of the motion of the car. At high speeds, about 50% of the car's fuel is consumed to overcome the drag. By reducing drag, we can not only reduce fuel consumption, but also can improve stability, achieve high speed, and indirectly reduce global warming. The skin friction as well as the pressure difference that exists due to the flow separation at the rear of the car, both generate drag in the passenger car in low subsonic incompressible regime. In the last three decades, significant research has been done to reduce the drag of passenger cars. Drag coefficient (CD) can be decreased by reducing the weight of the car but this technique is not an effective approach, as 0.003 of CD reduction can be achieved by reducing 10-15 kg of a car. Therefore, 'Passive' (add-on devices and topology modification) and 'Active' (steady jet flow) control techniques are mostly used to minimize drag. Some common techniques are hence the use of spoilers and diffuser plates. In our proposed work, Solid works ® was used for CAD followed by computational fluid dynamics (CFD) analysis using ANSYS ®. Results of Drag and Lift were thus obtained,

which were compared with the original clean design. It was found that vortex generator and diffuser were useful add-on devices, that resulted in a 3.6 % reduction in coefficient of drag and 1.8 % reduction in fuel consumption.

Keywords: Passenger car drag reduction, Aerodynamic passenger car, Diffuser effect on the car, Pressure drag, Flow separation, active and passive flow control, Automobile's aerodynamics.

Paper ID: ICASE2021-8-APM-2

RBF-PS Method to Examine Eventual Periodicity of Linearized KdV Equation

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KdV equation is one of the famous evolution equation appeared in the theories of shallow water waves with large wave length and small wave amplitude. Also the distinctive subjective components of arrangements for some evolution equations, linked to their large-time behavior known as eventual periodicity with time disclosed in laboratory tests throughout initial-boundary-value problems (IBVPs) solution on a limited domain with periodic boundary conditions. In this study using a meshless methodology known as the Radial basis function pseudo spectral (RBF-PS) method is utilized to numerically examine this periodicity for solution of linearized KdV equation.

Keywords: KdV Equation, Eventual Periodicity, RBF Meshless Method, RBF-PS Scheme.

Paper ID: ICASE2021-8-APM-3

Simulations for Boundary Layer Flows and Heat Transfer of Cross Fluid over a Moving Flat Plate

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During the past century, rheology has emerged as a new science, which deals with the deformation of the matter. Metal spinning, wire drawing, polymer extrusion, blood circulation, food industry, and pressure-sensitive adhesion, etc are a few of the potential application areas. Now in most of these applications materials are non-Newtonian and involve rotation, extrusion, and heat exchange. Therefore, understanding the rheology is critically important to improve the quality of product development, methodology, and resource utilization. The goal of this research is to present the boundary layer equations for fluid flow and heat transfer of cross fluid over a moving flat plate. Systems of governing partial differential equations are converted into highly non-linear ordinary differential equations by introducing suitable similarity transformations. By using the bvp4c process, the governing ODEs are solved numerically, and the influence of the related parameters of practical importance such as skin friction coefficient and Nusselt number are calculated. The momentum boundary layer demonstrates the elevation impact of the growing local Weissenberg number. The contrary phenomenon for the thermal boundary layer was found. The temperature function has an exceptional S-shaped profile indicating the existence of an adiabatic case for the large enough wall to ambient temperature ratio. Velocity fields and the structures of the momentum boundary layer demonstrated the same enhancement tendency for the rising Weissenberg number.

Keywords: Boundary layer, Cross fluid, Numerical solution.

Paper ID: ICASE2021-8-APM-5

Simulations of Thin Gray Fluid over a Moving Flat Plate

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The research presents a generalized numerical solution valid for all temperature differences i.e. for both the cases when $\boldsymbol{\theta w=1}$ (Linear Radiations) and for $\boldsymbol{\theta w>1}$ (Non-Linear Radiations) of thin gray fluid. Firstly, the two-dimensional boundary layer equations for fluid flow and heat transfer of thin Gray fluid over a moving flat plate are presented. The systems of governing partial differential equations are converted into highly non-linear ordinary differential equations by introducing appropriate similarity transformations. By using Runge-Kutta numerical integration, the governing ordinary differential equations are solved, and the effects of the related parameters of practical importance are studied. The results of the research conclude that the non-dimensional parameter temperature ratio parameter $\boldsymbol{\theta w}$ shows thinness in the boundary layer. The Radiational effects are strengthened as $\boldsymbol{\theta w}$ becomes greater than 1. Prandtl number $\boldsymbol{Pr}$ and Radiation Parameter $\boldsymbol{Rd}$ show the same effects when there is an increment in their values, thermal boundary layer thickness increases by 103.3 % and 336.6% in the case of $\boldsymbol{Rd}$.

Keywords: Boundary layer, Gray fluid, Numerical solution.

Paper ID: ICASE2021-8-APM-6

Estimation of Drag Reduction of a Cargo Tractor-trailer using CFD Analysis in Different Configurations

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Conventional cargo tractor trailer vehicles with blunt body have poor aerodynamic design,

which results in high drag force and high fuel consumption at highway speeds (above 70 km/hr). In this study, improvement in aerodynamic design of cargo freighters is proposed for better fuel economy. Computational Fluid Dynamics (CFD) was employed to numerically investigate the flow characteristics at both rear and front of the vehicle. Flow physics in terms of velocity distribution, pressure distribution and turbulent kinetic energy around the vehicle is studied. The vehicle is modelled in different configurations for improved pressure distribution. This study presents the numerical simulation basis for the reduction in cargo trailers' drag for better fuel economy.

Keywords: CFD, Aerodynamics, Drag, Tractor-Trailer.

Paper ID: ICASE2021-8-APM-7

Design, Analysis and Fabrication of Composite Curing Compressive Mold for Aerospace Application

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An undeniably significant development in the aviation business is the utilization of composite materials, as these empower designers to conquer the boundaries made by utilizing metals. Composite materials have assumed a significant part in weight reduction, and consequently they are utilized for both primary applications and segments of all space apparatus and airplane from UAVs and sight-seeing hot air balloon to military aircraft, space transport and traveler carriers. During this research, an extensive literature review was performed on the composite curing techniques and the equipment used in this procedure. As it is known that many of the aerospace components like skins, wing-box even landing gear are being made up of composite material. For this purpose, the compressive mold was design and developed for fabrication of specimen to study the effect of temperature and pressure on product during curing was conducted. CAD assembly of the design was modeled in SOLIDWORKS®. The design was kept simple for ease in manufacturing and to keep the cost as much low as possible. The analysis was carried out in ANSYS®. The analysis consisted of static structural and transient thermal analysis

using different materials available in the market to test whether the design can withstand the high temperature and pressure environment for composite curing. The design and material were suggested after validation through analysis and the mold was fabricated. The fabricated mold will be used for research purposes to determine a curing process cycle and its effect on the composite product properties.

Keywords: Composite Curing, Compressive mold, Design and Analysis, ANSYS, Transient Structural, Structural Integrity

Paper ID: ICASE2021-8-APM-9

Normal and Oblique Ballistic Impact on Monolithic 5083 Aluminum Plate

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Experimental investigation was conducted to determine the ballistic performance of monolithic 5083 armoured plate. In the first phase of experimental work, chemical and mechanical characteristics of Aluminum 5083 were determined and compared with the requirements specified for ballistic materials in UK MOD DEF STAN 95-22, USA MIL-DTL-46027K (MR) and UK MOD DEF STAN 95-22. In the second phase, ballistic tests were conducted to ascertain the performance of monolithic 31.75 mm Aluminum 5083 plate against 7.62 x 39 mm Armour Piercing Incendiary rounds using service rifle in ordnance velocity range. The plate was impacted at normal and oblique angles. Non perforation of the studied configuration at oblique angle was taken as a measure for ballistic efficiency. The study used experimental optimization to find the minimum oblique angle to stop the projectile from perforation. The effective thicknesses, impact and exit side diameters, deflection of projectiles and failure modes were discussed. It was found that obliquity appreciably enhances the ballistic resistance of the studied plate.

Keywords: Ballistic impact, ballistic resistance, ballistic efficiency, Ballistic Limit Velocity (BLV), bullet deflection, oblique impact, projectile impact, bullet impact experiments

Paper ID: ICASE2021-8-APM-10

Design, Analysis and Fabrication of a Hydro Vortex Turbine

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Global energy consumption is growing considerably, raising such issues as increased energy-related greenhouse gas emissions, reduced security of supply, and growing fuel costs. Renewable resources, such as hydropower, offer an alternative energy source to meet the growing demand. Hydropower is the most suitable and efficient source of renewable energy. Hydropower generation can be divided into two categories. One system needs a large reservoir to produce energy while another system needs the continuous flow of water and does not a dam which can be also be called as 'run of river' system. Hydro vortex turbine is an example of the latter category. Vortex Turbine is a low head hydropower system. HVT exploits the energy available in a vortex flow, enabling hydropower generation at heads as low as 0.3m. A vertical axis turbine is located in the center of a vortex flow and rotates with the flow, thus generating mechanical energy, which can be converted into electrical energy through a generator. This paper describes a parametric experimental investigation of the operating conditions of HVT. Models of basin, blades of turbines and an assembly model are designed in a Modelling Software called CATIA. These models are then analyzed through CFD simulation on a software called ANSYS. The initial conditions, boundary conditions, parameters and mediums are provided accordingly. The power input, power output and efficiency are then calculated and compared for the various settings. At the end of our software analysis, the assembly design is fabricated and coupled with a generator for the testing of power generation.

Keywords: Hydro Vortex Turbine (HVT), Computational Fluid Dynamics (CFD), Turbine Casing

9: Astronomy, Astrophysics & Astrobiology

Paper ID: ICASE2021-9-AAA-1

Libration Points of Space

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In the world of space, in the region of zero gravity, some places are found to have balanced forces and can be proved to be stable areas of space. On the basis of three-body problem, in any system of two celestial massive bodies, these points are present by Nature and act as parking places in space. By years, this phenomenon is used by agencies to explore many areas of space. They are total 5 in number and categorized as stable and unstable Libration points. Their stability depends upon how much an object, placed there, can change its initial position after experiencing small perturbation. These points act as point of equilibrium where spacecraft may be parked to make observations

Keywords: Balanced Gravity, Gravitational Law, Imaginary and Real Eigen Values, Linear Stability Analysis, Three-body Problem

Paper ID: ICASE2021-9-AAA-2

Growth and Survival Analysis of Rhizosphere Soil Bacteria in a Recently Developed Mars Soil Simulant under Martian Conditions

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Initial Mars colonizers priority list will encompass growing plants on the red planet. Growth of plants on Mars have a significant importance ranging from being an essential food source to oxygen production and raw material for manufacturing purposes. Rhizosphere dwelling bacteria perform key functions in the growth and development of plants. In this study, the growth and survival of rhizosphere soil bacteria were examined for a period of 7 days in Khyber Pakhtunkhwa Red Mountainous Soil (KP-Mars-1), representing Mars soil simulant. KP-Mars-1 is our identified Mars soil simulant, characterized and refined by us. It exhibits similar elemental composition as Mars soil and can potentially be used as a Mars soil simulant. The simulated Mars conditions provided in this study for the analysis of bacterial growth and survival consisted of temperature range of + 24 °C (Mars day) and negative – 20 °C (Mars night), low soil moisture content, anaerobic atmosphere (carbon dioxide dominant) and UV-C ionization radiation (200nm – 280nm). These conditions are tested alone for their effects on rhizosphere soil bacteria growth and survival when inoculated in KPMars-1. Nutrient broth culture of 3.6 mL was inoculated in 5g of KP-Mars-1. The culture was having an O.D. of 1 with 7.63 x 108 / 100µl. The growth and survival of rhizosphere soil bacteria were analyzed at 1, 3 & 7 days interval. Rhizosphere soil bacterial were able to survive all of the provided Mars conditions. A significant amount of bacterial cells died in Mars simulated temperature and UV-C radiations. A significant growth was observed only in anaerobic (carbon dioxide dominant) conditions. Our study may have implications for early Mars astronauts in deciding which bacteria should be considered to be tested on Mars for effective growth of plants.

Paper ID: ICASE2021-9-AAA-4

Deinococcus Radiodurans as a Chassis for Synthetic Biology Experiments in Space Biology

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Interplanetary space travel and the colonization of Mars come with several key challenges due to the extreme environment. Various microbes have been reported to have capabilities that can help them survive harsh Martian and space conditions such as Deinococcus geothermalis, Bacillus subtilis, Pseudomonas aeruginosa, Candida albicans, Escherichia coli and Micrococcus luteus. Phenotypic features which enable these organisms to withstand harsh environments include robust cell envelopes, high proliferation rates, biofilm formation, production of antioxidants and formation of endospores. Some of these stress resistant microbes exist as an aggregation of cells known as a biofilm, which are surrounded by the Extracellular Polymeric Substance (EPS) layer that acts as a barrier and protects the cells from external conditions. One promising candidate for a strong chassis (a synthetic cell genetically engineered to express genetic devices engineered using synthetic biology tools) is Deinococcus radiodurans owing to its ability to remain viable after being exposed to extreme conditions, efficient proteomic shielding, production of novel carotenoids and high transformability. Here, we explored the natural potential of D. radiodurans by the identification of individual features it possesses as an optimal chassis. Furthermore, analysis of transcriptomic datasets from the literature, revealed 14 Differential Expressed Genes (DEGs) that confer survival and chassis features to D. radiodurans. This data could then be used to construct a desirable synthetic device (chassis) that could be used for Synthetic Biology purposes and in future missions to Mars.

Keywords: Deinococcus radiodurans, Synthetic Biology, chassis, LEO, Martian and Space conditions

Paper ID: ICASE2021-9-AAA-6

Event Rate of Extreme Mass Ratio in Spiral Systems in M32 Galaxy

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After growing consensus of scientific fraternity that, there exist a black hole (MBH) in the center of every galaxy. The surrounding environment of MBH in the galactic center contains a very dynamic presence of stellar cluster giving rise to systems comprising of a massive black hole (MBH) and a population of stellar-mass compact-object (CO), typically stellar-mass black hole (BH), neutron stars (NS) and white dwarfs(WD). As the COs become gravitationally bound with the central MBH forming extreme mass ratios binary systems, having prolonged 104 to 105 cycles, which are anticipated candidates for future space-born Laser Interferometer Space Antenna (LISA) to detect gravitational waves from these inspiralling binaries. These CO-MBH systems are producing complex gravitational waves (GW) during their evolution with weak strain amplitudes, leading to the last stable orbit around the MBH. We inspect the relationship between signal–to–noise ratios (SNRs) and informative parameters of these gravitational wave generating binary sources, and developed a generalized linear model inferring their properties. Intrinsic parameters of Analytical Kludge (AK) waveform model were restrained, by employing the well-established understanding of the MBH to extrapolate the scaling relation, which envisages a fiducial fit for back–of–envelop computations of SNRs. We compute the averaged probability of 9.39 EMRI events detectable in LISA mission lifetime, to occur in M32 galaxy hosting a MBH, considering the sensitivity of the LISA detector.

Keywords: Compact Objects (COs), Analytical Kludge Waveform(AKW), Laser Interferometer Space Antenna (LISA), Extreme Mass Ratio Inspirals (EMRIs), Massive Black Hole (MBH)

Paper ID: ICASE2021-9-AAA-8

Gamma-Ray Burst High-Latitude Emission: Simulating the Propagation Effect

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Relativistic outflows in Gamma-ray Bursts (GRBs) are collimated into jets with narrow angles due to the beaming effect. In simple kinetic models, these jets are composed of relativistic, emitting shells with spherical geometry causing a propagation effect: emission that abruptly stops results in the observed flux decaying with time, rather than immediately ceasing. We study the propagation effect in isolation by generating random, uniform emission from the surface of a static shell. We then simulate emission profiles and study the corresponding observed profiles. Time-varying emission is seen to be delayed by a time scale that is consistent with the angular spreading time scale found in literature. In particular, we find that the presence of flux variations in the observed profile depends on the size of the emission region relative to the time scale of pulses in the emission profile.

Keywords: Gamma-ray bursts, curvature effect, angular spreading

Paper ID: ICASE2021-9-AAA-9

Storm Time Ionospheric Variations from GNSS TEC and Swarm Satellites

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The geomagnetic storms cause severe threat to the performance of Global Navigation Satellite System (GNSS) and other satellites and it is also vulnerable to everything on the Earth. Similarly, ionosphere is dedicated to low down the arrival of different plasma parameters from the Sun, including CME (Coronal Mass Ejections) and solar flares. The aim of this work is to study the

ionospheric responses to large geomagnetic storm (Kp > 8) throughout the whole world to study the different ionospheric variations. For this purpose, data from GNSS, and Swarm satellites are studied for the storm time ionospheric responses. We have analyzed the storm during March 16-29, 2015, and during this storm, we have checked the different ionospheric parameters. The ionospheric variations are checked in multiple stations of Asia, Africa, Australia, America and Europe by the analysis of TEC (Total Electron Content) over globe and ionospheric response through the analysis of Swarm satellites. In this work, an explanatory analysis is presented from GNSS and Swarm satellites data and found the possible storm time variations in ionosphere during the storm initial and main phases. Strong positive storm time variations found in stations of Asia (KIT3, SOLA, IISC), Africa (AREQ, YKRO, NKLG) and, America (CHPI, IQQE, RIOP) continents, respectively. This analysis can aid to correct the ionospheric scintillations during geomagnetic storms of different intensities.

Keywords: Geomagnetic storm, Swarm satellites, GNSS, ionosphere, TEC, CME, sudden storm commencement.

Paper ID: ICASE2021-9-AAA-11

The Spectral Parameters of Gamma-Ray Blazars

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The blazars are the brightest astrophysical objects in the extragalactic gamma-ray sky and divided into two classes, Flat Spectrum Radio Quasars (FSRQs) and BL LAC objects (BL Lacs). Blazars emit radiation via non-thermal processes including synchrotron and inverse Compton (IC), and their multiband spectra are peaked and highly curved. We find that FSRQs show higher curvature than BL LACs, that might be due to complex radiation mechanisms. We investigate the relationship between spectral parameters of BL LACs to investigate the signatures of particle acceleration and cooling in plasma jets of blazars. The synchrotron peak frequency of BL LACs is correlated with the spectral curvature, that is a signature of stochastic particle acceleration. The synchrotron peak frequency also shows an inverse correlation with gamma-ray luminosity and the Compton dominance, that is a signature of blazar sequence. We, therefore, suggest that the synchrotron peak frequency in BL LACs is dominated by radiative cooling and arises due

to a cooling break, whereas the curvature might arise due to a stochastic particle acceleration mechanism.

Keywords: Galaxies, blazars, synchrotron, acceleration

10: Space Law, Management & Outreach

Paper ID: ICASE-10-SLMO-1

Strategizing Pakistan's Space Policy for Defensive Discourse: A Case Study of Pulwama-Balakot Crisis

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Outer space is a rapidly developing frontier that offers opportunities in all aspects of commercial and strategic domains. A well-established policy, which adheres to an appropriate strategy, proves to be helpful in realizing these opportunities. For a state such as Pakistan, that relatively has a small-scale space program with handful of satellites, which bear the burden of providing both commercial and strategic support to country, it requires a well-planned policy to exploit outer space technology emerging in international security domain. Pakistan should advance its space program for the strategic and defensive discourse as the hostile acts of the adversary in the region grows as evidently witnessed in the Pulwama-Balakot Crisis of 2019. The National Space Policy of Pakistan provides a framework for the development and launch of Lower Earth Orbit (LEO) and Geo-synchronous satellites, yet it lacks in various aspects of defensive strategy. It requires revision to reach technical advancement taking place in the field of space sciences leading to the development of Anti-Satellite (ASAT) weapons. While emerging technologies are making way into the international security, incidents like Balakot strike 2019 suggests that Pakistan should direct its space policy for its security and take a defensive discourse to devise a revised space policy. This paper resolves to explore the options for Pakistan to devise a defensive space policy that secures the space assets and the country.

Keywords: Space Policy, Pakistan Space Policy, Defensive discourse, Discourse Analysis, Pulwama-Balakot, National Space Policy

Paper ID: ICASE-10-SLMO-3

Legal Regimes and the Issue of Weaponization of Outer Space

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The prevailing arms race in outer space is considered as a right of self-defense of states, which is bestowed by international law. States adhere and espouse to legal regimes but maintain a right of self-defense. Often, states leverage loopholes in these regimes for pursuing space-centric military interests for maintaining power, hegemony, survival, balance-of-power, or deterrence. Prevention of an Arm Race in Outer Space (PAROS) negotiations for restraining active military space weapon systems have remained on the agenda of the Conference on Disarmament (CD), though deadlocked in advancing given the consensus decision-making model and the opposition of states, especially the United States. Lack of interpretation of definition and the loopholes in the law provides spacefaring states freedom to pursue strategic interests by amalgamating space with terrestrial warfighting capabilities. The dependence on space assets encourages space powers to formulate space polices of space assurance, space dominance, space situational awareness, and space offensive and defensive control. By many accounts, space is, or will be, weaponized with negative impacts on international, regional, and national security dynamics. This paper investigated to what extent international law can mitigate these negative impacts associated with both the militarization and weaponization of space.

Keywords: Prevention of an Arm Race in Outer Space (PAROS), Conference on Disarmament (CD), Committee on Peaceful Use of Outer Space (COPUOS), Outer Space Treaty (OST), Space Law, Moon Agreement

Paper ID: ICASE-10-SLMO-4

Space Weaponization: Challenges and Ramification for International Security

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Active and passive military use of space is difficult to rebuff. The amalgamation of space assets with terrestrial war fighting capabilities increases the national, international and space security concern. Militarization or passive military use of outer space is different from weaponization or the active military use of outer space. The objective of this article is to address the issue/ concern of weponizaition of outer space through two different perspectives; firstly, spacefaring states are developing space weapons and their pursuance of offensive space control doctrine are ameliorating security concern at every level. Secondly, the existing regimes and the laws are having deficiencies in curbing weponizaition of outer space. Space weapons are not deployed in outer space, but their possession has lowered the threshold of using them in future. The prospects of weaponization of outer space cannot be snubbed. Space endeavors, policies, doctrine and existence of dual use of space assets are the factors that is complicating the international space politics and challenging the international security and regional stability.

Keywords: Militarization of space, Weaponization of Space, PAROS, Space law, Space policies, Security

Paper ID: ICASE-10-SLMO-5

Role of Private-Public Partnerships in Creation of Space Awareness and Outreach in Pakistan

Danial Amin[1], Faaiz A. Jeelani[2, 3], Usama Ahmed[2, 3], Dr. Najam Abbas Naqvi[2, 3]

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Creating space awareness and outreach is an important step in the journey towards the creation of a space nation. The need for a space-themed awareness and outreach program is fundamental in the overall dynamics of a space nation. To create space awareness among the general public, different sectors of society play their fundamental role. Private-public partnerships play a vital role in creating significant impacts in different domains. In this context, the role of different private-public partnerships for the creation of space awareness and outreach is discussed. The role of private-public partnerships is evaluated in terms of their contribution towards the creation of space awareness and outreach. The role of private-public partnerships is evaluated using the qualitative and quantitative analysis of the roles in the domains of planning, development, execution, and implementation. This role is then compared with the role of private-public partnerships in other domains including the energy sector, e-commerce, industry, and education. From the conducted research it is observed that the role, of private-public partnerships, is less significant in the domains of space awareness and knowledge creation. There is significant room for improvement in this regard which can be obtained by developing more targeted and goal-oriented partnerships.

Keywords: Space Awareness, Outreach, Space Nation, Private-Public Partnerships, Role, Significance

Paper ID: ICASE-10-SLMO-6

The Role of National Centers in Sustainable Development of Pakistan

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In order to facilitate the research and development paradigm of the country, national centers are envisioned and developed under the patronage of Higher Education Commission and Planning Commission of Pakistan. These centers are a consortium of laboratories developed at various HEIs working in a targeted domain. Some of these centers have been in existence for the last three years and are near the completion of their project duration. To further establish the need of such centers in other targeted domains, it is reasonable to consider their contribution towards the sustainable development of the nation in the context of United Nation Sustainable Development Goals. This study will be conducted using the qualitative as well as quantitative research methodologies on the data collected from semi-structured surveys in the domains of outreach, engagement, awareness, technical innovation, and human resource development. The survey is conducted for the targeted audience of the members affiliated with the subject centers and is then further analyzed using the Rochester's Institute of Technology's design thinking methodology. It is observed that the centers play a vital role in the outreach, engagement, and the awareness domains. Further work is required to be carried out in the additional domains to create long lasting impact in the context of UN SDGs.

Keywords: Sustainable Development Goals, Design Thinking, United Nations, Centers, Higher Education Commission, Planning Commission of Pakistan

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

List of Accepted Posters

Institute of Space Technology

Sr. No.	Paper ID	Author's Name & Affiliation	Research Title
Aeronautics & Astronautics			
1.	1-AA-14	Jahanzeb Tariq Khan *National University of Sciences and Technology, Pakistan*	Impact of Sampling Delays and Communication Breakdown on the Stability of Spacecraft Formation
Satellite Technology			
2.	2-ST-5	Asim Khan *Institute of Space Technology, Pakistan*	GPS TEC anomalies associated with Mw>7 earthquakes in Japan
3.	2-ST-8	Sana Asif *Institute of Space Technology, Pakistan*	Design of low cost AIS receiver for ICUBE-N
Information & Communication Technologies			
4.	3-ICT-12	Dr. Azhar Imran Mudassir *Air University, Pakistan*	Rise of Educational Software and Impact of COVID-19 Outbreak in Pakistan
Geographic Information Science			
5.	5-GIS-1	Masood Bari *University Of Karachi, Pakistan*	Find The Shortest Route With The Help Of Network Analysis
Environment & Climate Science			
6.	7-ECS-5	Muhammad Abdul Moiz *Institute of Space Technology, Pakistan*	Computational Study of Fe-Doped ZnO as a Photocatalyst to Reduce the Environmental Pollution from Textile Industry

Astronomy, Astrophysics & Astrobiology			
7.	9-AAA-3	Haniya Usmani *Generation's School, Pakistan*	The Perks Of Space Exploration
8.	9-AAA-7	Quratulain Danish *CECOS University of IT & Emerging Sciences, Pakistan*	Network analysis of DEGs with putative roles in neuronal development under microgravity conditions

Seventh International Conference On

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Workshops and Trainings

Institute of Space Technology

1. Workshop on Geomagnetism & Ionosphere

Overview	The main objective of the Workshop is to develop capacity of aspiring students/graduates and young professionals in the field of geomagnetism and ionosphere by imparting onsite training on observatory operation and lectures by international experts on space weather research, operations, and services.
Facilitators	1. **Dr. Jean L. Rasson,** Ex-Head of Department Royal Institute of Meteorology Dourbes, Belgium 2. **Prof. A. Babatunde Rabiu** Professor and Director of Physics Centre for Atmospheric Research, National Space Research and Development, Abuja, Nigeria 3. **Prof. Mamuro Ishii** Director of Space Environment Laboratory, NICT Japan 4. **Dr. Christine Amory-Mazaudier** Senior Scientist University Pierre and Marie Curie Staff Associate, ICTP France 5. **Mr. Christian Monstien** Ex Radio Engineer ETH Zurich University Switzerland 6. **Dr. Zahra Bouya** Space Weather Scientist Australian Bureau Meteorology, Australia 7. **Mr. Relly Margiono** Researcher/ lecturer Badan Meteorology, Climatology and Geophysical Agency, Indonesia 8. **Dr. Pornchai Supnithi** Professor

	Faculty of Engineering, King Mongkut's Institute of Technology, Ladkrabang, Thailand 9. **Dr Munawar Shah** Associate Professor Institute of Space Technology, Islamabad, Pakistan

2. Workshop on Small Satellite (CubeSat) for Earth Observation Application Design

Overview	This workshop will cover conceptual design of an EO CubeSat for a selected EO mission with primary focus on mission and orbit design, payload selection, sizing and subsystem analysis and drawings
Facilitator	**Prof. Dr. Alim Rüstem Aslan** Professor Space Systems Design and Test Laboratory Department of Aerospace Engineering Istanbul Technical University (ITU) Turkey

3. Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection

Overview	This workshop is designed to implement an intelligent computer vision algorithm to detect celestial objects in wide field deep sky astronomical images using Python programming language. This workshop will also aim to provide a broad overview of Computational Astrophysics that combines modern computational methods, advanced algorithms, and original software implementations to discover new phenomena, and to make predictions in astronomy.
Facilitator	1. **Dr. Ali Ismail** Professor NED University of Engineering & Technology (UET) Pakistan

	2. **Uzair Abid** Software Engineer Team lead National Center in Big data and Cloud Computing, Pakistan 3. **Talha Zia** Polymer Engineer Research Associate National Center in Big data and Cloud Computing Pakistan

4. Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing

Overview	This workshop will introduce SAR as an imaging radar instrument, and its use in Earth Remote Sensing. The basic SAR imaging mechanisms will be discussed, followed by an introduction to satellite-based SAR systems, data processing tools, data analysis basics, and SAR image interpretation / analysis. The vast range of SAR remote sensing applications will be discussed, followed by hands-on exercises on ESA SNAP software
Facilitator	**Dr. Waqas A. Qazi** Chief Technology Officer Offshore Monitoring Ltd. Cyprus

5. Workshop on Optical Remote Sensing & Geographic Information Science

Overview	This workshop is organized to acquire and enhance the theoretical background, process, functions and hands-on exercise on the GIS and remote sensing and its applications in the geosciences. This workshop is will develop and enhance the capacity of the post-graduate students, mid-carrier professionals to provide basic knowledge of these technologies' utilization of the free satellite data, software's and online resources to effectively implement a mid-level project.

Facilitator	**Dr. Muhammad Shafique** Associate Professor National Centre of Excellence in Geology, University of Peshawar, Pakistan

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

Conference Technical Program

Institute of Space Technology

Seventh International Conference on Aerospace Science & Engineering (ICASE 2021)
Islamabad, Pakistan

Program Day 1: Tuesday, December 14, 2021

Time (PKT) Hours	0830-0945	0945-1100	1100-1130	1130-1300	1300-1415	1415-1600	1600-1745	1930-2130
Auditorium, Raza Block	Registration Confirmation & Reception	Inaugural Ceremony	Networking Break Eatery Side Lawn	Conference Plenary Session International Keynote Speakers	Lunch & Prayer Break Eatery Side Lawn	Summit on the Role of HEC & National Centers in Emerging Technologies	Plenary Session (GNSS & Space Weather)	Conference Dinner & Stargazing Institute of Space Technology
Video Conference Room, Raza Block						Symposium on Modern Aerospace Systems	Symposium on Geographic Information Science & Space Applications	
GREL, Raza Block				Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection		Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection	Workshop on Use of Artificial Intelligence/Machine Learning for Celestial Object Detection	
Computer Lab 123, Raza Block						Workshop on Small Satellite (CubeSat) Design for Earth Observation Applications	Workshop on Small Satellite (CubeSat) Design for Earth Observation Applications	
Class Room 206, Raza Block							Panel Discussion (Space Law, Management & Outreach)	
Class Room 207, Raza Block						Technical Session (Aeronautics & Astronautics)	Technical Session (Aeronautics & Astronautics)	
Class Room 218, Raza Block						Technical Session (Information & Communication Technologies)	Technical Session (Environment & Climate Science)	
Class Room 6228, Farooque Block						Technical Session (Remote Sensing & Photogrammetry)	Technical Session (Satellite Technology)	
Class Room 6229, Farooque Block						Technical Session (Position, Navigation & Timing)		
Exposition Arena, Raza Block		Product & Poster Exhibition Exposition Visit by Chief Guest						

			Program Day 2: Wednesday, December 15, 2021					
Time (PKT) Hours	0830-0915	0915-1100	1100-1130	1130-1300	1300-1415	1415-1600	1600-1745	1930-2130
Auditorium, Raza Block	Registration Confirmation & Reception	Meet The Scientists Forum (Careers in Space)	Networking Break Eatery Side Lawn Networking Break Eatery Side Lawn	Plenary Session (Remote Sensing & Geographic Information Science)	Lunch & Prayer Break Eatery Side Lawn	Science Diplomacy Session	Summit on Geographic Information Science & Space Applications	Shopping Visit & Dinner Giga Mall & DHA - 2, Islamabad
Video Conference Room, Raza Block		Symposium on GNSS & Autonomous Systems		Technical Session (Astronomy, Astrophysics & Astrobiology)				
GREL, Raza Block		Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing		Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing				
Class Room 206, Raza Block		Panel Discussion (Remote Sensing & Geographic Information Science)		Forum 360: STEM Education				
Class Room 207, Raza Block		Technical Session (Satellite Technology)		Technical Session (Aeronautics & Astronautics)		Technical Session (Aeronautics & Astronautics)	Technical Session (Aeronautics & Astronautics)	
Class Room 218, Raza Block		Technical Session (Geographic Information Science)		Technical Session (Satellite Technology)		Technical Session (Environment & Climate Science)		
Computer Lab, Farooque Block		Workshop on Geomagnetism & Ionosphere		Workshop on Geomagnetism & Ionosphere		Workshop on Geomagnetism & Ionosphere	Workshop on Geomagnetism & Ionosphere	
Class Room 6228, Farooque Block						Technical Session (Information & Communication Technologies)		
Class Room 6229, Farooque Block		Technical Session (Space Law, Management & Outreach)		Technical Session (Position, Navigation & Timing)		Technical Session (Remote Sensing & Photogrammetry)		
Exposition Arena, Raza Block							Research Poster Display	

Program Day 3: Thursday, December 16, 2021								
Time (PKT) Hours	0730 - 0830	0830 - 1130	1130 - 1145	1130-1300	1300-1415	1415-1600	1600-1745	1930-2130
Auditorium, Raza Block	Registration Confirmation & Reception	Session on Space Science, Technology & its Applications for Socio-economic Development	Networking Break Eatery Side Lawn Networking Break Eatery Side Lawn	Plenary Session (Aeronautics & Astronautics)	Lunch & Prayer Break Eatery Side Lawn	Space Science & Technology Cooperation Session	Closing Ceremony	Heritage Visit & Dinner Lok Virsa, Pakistan Monument & Monal
Video Conference Room, Raza Block				STEP Stakeholders' Forum		Technical Session (Astronomy, Astrophysics & Astrobiology)		
GREL, Raza Block				Workshop on Optical Remote Sensing & Geographic Information Science		Workshop on Optical Remote Sensing & Geographic Information Science		
Class Room 206, Raza Block				Panel Discussion (GNSS & Space Weather)		Panel Discussion (Small Satellite Technology)		
Class Room 207, Raza Block						Technical Session (Aeronautics & Astronautics)		
Class Room 218, Raza Block				Technical Session (Position, Navigation & Timing)		Technical Session (Position, Navigation & Timing)		
Computer Lab, Farooque Block		Workshop on Geomagnetism & Ionosphere		Workshop on Geomagnetism & Ionosphere		Workshop on Geomagnetism & Ionosphere		
Class Room 6228, Farooque Block				Technical Session (Information & Communication Technologies)				
Class Room 6229, Farooque Block				Technical Session (Remote Sensing & Geographic Information Science)		Technical Session (Applied Physics and Mathematics)		
Exposition Arena, Raza Block		Product & Poster Exhibition Exposition Visit by Chief Guest						

Day 1

Tuesday, December 14, 2021

Seventh International Conference on Aerospace Science & Engineering (ICASE 2021) Islamabad, Pakistan			
Day 1, Tuesday, December 14, 2021			
Time (PKT) Hours	**Program**		**Venue**
0830 - 0945	**Registration Confirmation & Reception**		**IST Gate 1 & Raza Block**
0945 - 1045	**Inaugural Ceremony**		**Auditorium, Raza Block**
1045 - 1130	**Group Photograph, Exhibition Visit & Networking Break**		**Eatery - Side Lawn**
1130-1300	**Conference Plenary Session**		**Auditorium, Raza Block**
	Chair: Dr. Suhail Akhter, Dean Institute of Space Technology / Technical Committee Chair - ICASE 2021 **Co Chair & Moderator:** Dr. Najam Abbas Naqvi, Chairman NCGSA / Secretary ICASE		
	Title of Presentation	**Speaker**	**Organization**
1130 - 1150	The History of Life, The Universe and Everything	Dr. Andris Slavinskis	UT Tartu Observatory, Estonia
1150 - 1210	The Role of Geographic Information Sciences in Managing the COVID-19 Pandemic	Dr. Ali Nouh Mabdeh	Al-Bayt University, Jordan
1210 - 1230	Small Satellite Constellations for EO and IOT Applications, Latest Developments in Turkey and Abroad	Dr. Alim Rüstem Aslan	Istanbul Technical University, Turkey
1230 - 1300	GNSS and Space Weather in Africa in The Framework of the North-South Scientific Network GIRGEA	Dr. Christine Amory Mazaudier	Institut Polytechnique de Paris, France
1200 - 1800	**Workshop on Use of Artificial Intelligence / Machine Learning for Celestial Object Detection** *Dr. Ali Ismail - NED University of Engineering and Technology, Pakistan*		**GREL, Raza Block**
1300 - 1415	**Luncheon: Networking & Prayer Break**		**Eatery - Side Lawn**
1415 - 1615	**Summit on the Role of HEC & National Centers in Emerging Technologies**		**Auditorium, Raza Block**
	Chair & Moderator: Mr. Ghulam Sarwar, Coordinator (National Centers) Higher Education Commission, Pakistan		
	Presentation Scope	**Speaker**	**Organization**
1415 - 1435	Role of HEC & National Centers in Emerging Technologies	Mr. Ghulam Sarwar	Higher Education Commission, Pakistan
1435 - 1455	National Center for Cyber Security	Prof. Dr. Kashif Kifayat	National Center for Cyber Security, Pakistan
1455 - 1515	National Center of Robotics and Automation	Mr. Muhammad Qasim Altaf	National Center of Robotics and Automation, Pakistan
1515 - 1535	National Center in Big Data and Cloud Computing	Dr. Naveed Arshad	National Center in Big Data and Cloud Computing, Pakistan
1535 - 1555	National Center of Artificial Intelligence	Dr. Yasar Ayaz	National Center of Artificial Intelligence, Pakistan
1555 - 1615	National Center of GIS and Space Applications	Dr. Najam Abbas Naqvi	National Center of GIS and Space Applications, Pakistan
1415 - 1620	**Symposium on Modern Aerospace Systems**		**Video Conference Room, Raza Block**
	Chair & Moderator: Dr. Rehan Mehmood, National Center of GIS and Space Applications, Institute of Space Technology, Pakistan		
	Title of Presentation	**Speaker**	**Organization**
1415 - 1440	Investigation of Modular Energy Unit with Solar Panels in CubeSat	Dr. Zhigang Gao	Northwestern Polytechnical University, China
1440 - 1505	The Development and Early In-Orbit Results of the APSCO Student Small Satellite SSS-2A	Dr. Shufan Wu	Shanghai Jiao Tong University, China
1505 - 1530	Space Debris Hazards: The Case of UPMSat-2	Dr. Gustavo Alonso Rodrigo	Technical University of Madrid, Spain
1530 - 1555	Electrochemical Energy Storage Performance of Cobalt based Nanomaterials	Dr. Huiqing Fan	Northwestern Polytechnical University, China
1555 - 1620	Analogy Principle for Overall Cooling Effectiveness of Composite Cooling Structures With Film Cooling	Dr. LIU Cun-liang	Northwestern Polytechnical University, China

1415 - 1600	Technical Session: Aeronautics & Astronautics **Chair:** Mr. Gohar Majeed, Institute of Space Technology, Pakistan **Co Chair:** Dr. Umer Saleem, Institute of Space Technology, Pakistan **Coordinator:** Zilal Shakeel, Institute of Space Technology, Pakistan			Class Room 207, Raza Block
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1440	Keynote	Stability & Control Investigations for Versatile Aerospace Problems through CFD	Dr. Adnan Maqsood	National University of Sciences and Technology, Pakistan
1440 - 1500	1-AA-5	PanAir Study of Variation in Canard Location and Dihedral on Lift Characteristics of a Close-Coupled Wing-Canard Configuration	Muneeb Ahsan	Pakistan Aeronautical Complex, Pakistan
1500 - 1520	1-AA-17	Main Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V	Asim Mehmood	Institute of Space Technology, Pakistan
1520 - 1540	7-ECS-4	Design And CFD Analysis Of Outer Aerodynamics Of 10Kw Horizontal-Axis Wind Turbine	Noman Ahsan	University of Engineering and Technology, Lahore, Pakistan
1540 - 1600	1-AA-25	Aerodynamic Shape Optimization of Doubly Offset Serpentine Diffuser using Response Surface Methodology	Zohaib Altaf	Air University, Kamra, Pakistan
1415 - 1600	**Technical Session: Information & Communication Technologies** **Chair:** Professor Dr. Khurram Khursheed, Institute of Space Technology, Pakistan **Co Chair:** Dr. Amena Ejaz Aziz, Institute of Space Technology, Pakistan **Coordinator:** Naba Ahmad, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1440	Keynote	RF Energy Harvesting for Internet of Things (IoT) Applications	Associate Professor Dr. Nosherwan Shoaib	National University of Sciences and Technology, Pakistan
1440 - 1500	1-AA-13	Design and Development of Audio Processing and Speech Recognition Algorithm	Muhammad Aitessam Ahmed	Institute of Space Technology, Pakistan
1500 - 1520	3-ICT-5	Pick And Place Hand-Gestured-Robot For Physically Challenged People	Muhammad Ihtisham Babar	Air University, Islamabad, Pakistan
1520 - 1540	6-RSP-13	Hyperspectral Image Classification Using Unsupervised Learning Algorithms	Wafa Fatima	Institute of Space Technology, Pakistan
1540 - 1600	3-ICT-7	A Review of Vulnerabilities and Cyber-Security Threats Associated with Overseas Telecom Companies' Operations	Naveed Tahir	National University of Sciences and Technology, Pakistan
1415 - 1600	**Technical Session: Remote Sensing & Photogrammetry** **Chair:** Dr. Mark Van Der Meijde, University of Twente, Netherlands **Co Chair:** Dr. Muhammad Shafique, National Center of GIS and Space Applications, University of Peshawar, Pakistan **Coordinator:** Qaiser Abbas, Institute of Space Technology, Pakistan			**Class Room 6228, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	6-RSP-6	UAV Assessment of Crop Evapo-transpiration Dynamics in Winter Wheat and Barley under Varying Pressures of Fungal Diseases	Obaid-ur-Rehman	Pakistan Space & Upper Atmosphere Research Commission
1435 - 1455	6-RSP-4	Using Optical Remote Sensing and Radar Altimeter Data for Lake Volume Estimation of Manchar Lake, Pakistan	Muhammad Asim Mustafa	Institute of Space Technology, Pakistan
1455 - 1515	6-RSP-9	Landslide Hazard Assessment and Monitoring In Azad Kashmir Using Sentinel-1 InSAR Data	Labeeqa Zaheer	Institute of Space Technology, Pakistan
1515 - 1535	6-RSP-10	Detection of Thermal Fronts in the Arabian Sea Through SAR (Synthetic Aperture Radar) Imagery	Nadia Jabeen	Institute of Space Technology, Pakistan
1535 - 1555	6-RSP-12	Flood Mapping and Crop Damage Assessment using Sentinel-1 SAR GRD and Optical Data through Google Earth Engine	Tariq Abbas	Institute of Space Technology, Pakistan
1415 - 1600	**Technical Session: Positioning, Navigation & Timing** **Chair:** Dr. Relly Margiono, Sekolah Tinggi Meteorologi Klimatologi dan Geofisika, Indonesia **Co Chair:** Dr. Munawar Shah, Institute of Space Technology, Pakistan **Coordinator:** Laiba Ejaz, Institute of Space Technology, Pakistan			**Class Room 6229, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1440	Keynote	Pakistan's Geographical Position: Opportunities for Research in GNSS Domain	Dr. Abdul Malik Khan	embeddINN PVT. Ltd, Pakistan
1440 - 1500	6-RSP-3	Performance Evaluation of IRI Models Over Mid Latitude During Ascending Phase of Solar Cycle 25	Rasim Shahzad	GNSS and Space Education Research Lab, NCGSA, IST, Pakistan

1500 - 1520	4-PNT-6	Investigation of Seismo Ionospheric Anomalies Associated With the Mw 6.7 Mongolia Earthquake	Rimsha Ashraf	Institute of Space Technology, Pakistan
1520 - 1540	4-PNT-1	Multi-GNSS Navigation Performance Assessment and Improvement Quantification	Arif Hussain	Sukkur Institute of Business Administration University, Pakistan
1540 - 1600	4-PNT-12	Ionospheric Responses to Geomagnetic Storm of June 2015 over the Middle East Region from GNSS TEC and GUVI	Rabia Ali	Institute of Space Technology, Pakistan
1600 - 1745	**Plenary Session: GNSS & Space Weather**			**Auditorium, Raza Block**
	Chair: Dr. Christine Amory Mazaudier, Institut Polytechnique de Paris, France **Co Chair & Moderator:** Dr. S. Zaineb Farooq, Institute of Space Technology, Pakistan			
	Title of Presentation		**Speaker**	**Organization**
1600 - 1625	Introduction to Geomagnetic Observations		Dr. Jean L. Rasson	Royal Institute of Meteorology, Belgium
1625 - 1650	Multivariables Analysis to Assess Ionospheric Abnormalities Associated with The Outer Space		Dr. Nadia Imtiaz	Pakistan Institute of Nuclear Science & Technology
1650 - 1715	Build Geodetic Space Weather Research: Coupling Processes Between Magnetosphere, Thermosphere and Ionosphere		Dr. Andres Calabia Aibar	Universidad Politécnica de Madrid, Spain
1715 - 1740	Ionospheric Modelling		Mr. M. Ayyaz Ameen	Pakistan Space & Upper Atmosphere Research Commission
1600 - 1745	**Symposium on Geographic Information Science & Space Applications**			**Video Conference Room, Raza Block**
	Moderator: Ms. Maria Zubair, Punjab Information Technology Board, Pakistan			
	Title of Presentation		**Speaker**	**Organization**
1600 - 1625	Environmental Application of Remote Sensing: Examples from the Philippines		Dr. Eng. Ariel C. Blanco	Philippines Space Agency, Philippines
1625 - 1650	Assessing Slope Failures In Wellington City – The Story of 80 Years of Geospatial Data Processing And Analysis		Dr. Salman Ashraf	GNS Science, New Zealand
1650 - 1715	Understanding the dynamics of Siachen Glacier using Feature Tracking and Backscatter Intensity		Dr. Muhammad Usman	Hokkaido University, Sapporo, Japan
1715 - 1740	Land Suitability for Sugarcane in Punjab Province		Ms. Maria Zubair	Punjab Information Technology Board, Pakistan
1600 - 1745	**Panel Discussion: Space Law, Management & Outreach**			**Class Room 206, Raza Block**
	Moderator: Dr. Najam Abbas Naqvi, National Center of GIS and Space Applications, Institute of Space Technology, Pakistan			
	Panelists		**Organization**	
	Dr. Muhammad Sharif		Islamic World Educational, Scientific and Cultural Organization (ICESCO), Morocco	
	Dr. Abdul Waheed		GNSS & Space Education Research Lab, NCGSA, IST, Pakistan	
	Professor Dr. Qamar ul Islam		Institute of Space Technology, Pakistan	
	Mr. Hamza Hameed		Space Generation Advisory Council, Austria	
	Danial Amin		Space Technology Education & Popularization, Pakistan	
1600 - 1745	**Technical Session: Aeronautics & Astronautics**			**Class Room 207, Raza Block**
	Chair: Dr. Tamer Mekky Ahmed Habib, The National Authority of Remote Sensing and Space Sciences, Egypt **Co Chair:** Dr. Muhammad Farooq Haydar, Institute of Space Technology, Pakistan **Coordinator:** Baheej Sajjad, Institute of Space Technology, Pakistan			
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1600 - 1620	1-AA-19	Autonomous Control of a Quadcopter Using Machine Learning Algorithm	Muzaffar Habib	National University of Sciences and Technology, Pakistan
1620 - 1640	1-AA-27	Robust Non-Linear Dynamic Inversion Control System To Improve Stability Of Large Aircraft In Crosswind	Waseeq Siddiqui	Pakistan Aeronautical Complex, Pakistan

1640 - 1700	1-AA-29	Control System Design of Ornithopter Flapping Wing Unmanned Air Vehicle for Agile Performance	Zarrar Haider	National University of Sciences and Technology, Pakistan
1600 - 1745	**Technical Session: Environment & Climate Science** **Chair:** Dr. Mounkaila Mohamed, University Abdou Moumouni Niamey, Niger **Co Chair:** Dr. Zia ul Haq, National Center of GIS and Space Applications, University of the Punjab, Pakistan **Coordinator:** Hadia Faisal, Institute of Space Technology, Islamabad			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1600 - 1625	Keynote	**A Machine Learning Approach for Hydrological Time-Series Prediction: A Case Study of Gilgit River Basin**	**Dr. Dostdar Hussain**	**Karakoram International University, Pakistan**
1625 - 1645	7-ECS-1	Climate Change an Emerging Risk: A Case Study of Sutlej River Basin, Pakistan	Shahanshah Abbas	Institute of Space Technology, Pakistan
1645 - 1705	7-ECS-10	Dynamics Of Shisper Glacier Surge- Upper Hunza, Gilgit-Baltistan Using Geospatial Techniques	Maham Sajjad	University of the Punjab, Pakistan
1705 - 1725	7-ECS-6	Time Series Analysis Of Bindi Dheraja Riverine Forest Of Sukkar, Sindh, Pakistan Using Remote Sensing	Faisal Khalid	Shaheed Benazir Bhutto University, Sheringal Dir Upper, Pakistan
1725 - 1745	5-GIS-13	Atmospheric Monitoring Using Artificial Intelligence Models & Applications	Muhammad Mubeen	Pir Mehr Ali Shah Arid Agriculture University, Pakistan
1600 - 1720	**Technical Session: Satellite Technology** **Chair:** Dr. Moazam Maqsood, Institute of Space Technology, Pakistan **Co Chair:** Dr. Kamran Saleem, University of Central Punjab, Pakistan **Moderator:** Laiba Ejaz, Institute of Space Technology, Pakistan			**Class Room 6229, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1600 - 1620	1-AA-26	**Title of Presentation**	Irfan Mehmood	National University of Sciences and Technology, Pakistan
1620 - 1640	2-ST-15	Design and Development of a Portable Dish Antenna for SATCOM Man-Pack Terminal	Shujaat Hussain	National University of Sciences and Technology, Pakistan
1640 - 1700	5-GIS-3	Design and Implementation of Dual-Axis Solar Tracking System for Maximizing the Efficiency of Solar Cells	Umbreen Tariq	Air University, Islamabad, Pakistan
1900 - 2130	**Stargazing & Conference Dinner** *(by invitation only)*			**Institute of Space Technology, Pakistan**

Day 2

Wednesday, December 15, 2021

Day 2, Wednesday, December 15, 2021			
Time (PKT) Hours	**Program**		**Venue**
0915 - 1100	**Forum: Meet the Scientists - Careers in Space** **Moderator:** Dr. Najam Abbas Naqvi, National Center of GIS and Space Applications, Institute of Space Technology, Pakistan		**Auditorium, Raza Block**
	Panelists	**Organization**	
	Professor Dr. Alim Rüstem Aslan	Istanbul Technical University, Turkey	
	Dr. Christine Amory Mazaudier	Institut Polytechnique de Paris, France	
	Dr. Muhammad Sharif	Islamic World Educational, Scientific and Cultural Organization, Morocco	
	Dr. Tamer Mekky Ahmed Habib	The National Authority of Remote Sensing and Space Sciences, Egypt	
	Dr. Andris Slavinskis	UT Tartu Observatory, Estonia	
	Dr. Andres Calabia Aibar	Universidad Politécnica de Madrid, Spain	
	Dr. Muhammad Jawed Iqbal	University of Karachi, Pakistan	
	Dr. Kamran Saleem	University of Central Punjab, Pakistan	
0915-1100	**Symposium on GNSS and Autonomous Systems** **Moderator:** Dr. S. Zaineb Farooq, Institute of Space Technology, Pakistan		**Video Conference Room, Raza Block**
	Title of Presentation	**Speaker**	**Organization**
0915-0940	A Contribution to Short-Term Rapidly Developing Geomagnetic Storm Classification for GNSS Ionospheric Effects Mitigation Model Development	Professor Dr. Renato Filjar	University of Rijeka & Krapina, Croatia
0940-1005	Multifunctional Microsatellite Radio Occultation Observation Receiver Using BeiDou III B1C/B2a Signals—A BRAIA Supported Project	Dr. Xiaoliang Wang	Shanghai Jiaotong University, China
1005-1030	GNSS Opportunities and Challenges	Dr. Dinesh Manandhar	The University of Tokyo, Japan
1030-1055	TBD	Dr. Fillipo Neri	VirtuaLab SRL, Italy
0915 - 1300	**Workshop on Synthetic Aperture Radar (SAR) for Earth Remote Sensing** *Dr. Waqas A. Qazi - O.M. OffShore Monitoring Ltd. Cyprus*		**Geospatial Research and Education Lab, Raza Block**
0915 - 1100	**Panel Discussion: Remote Sensing & Geographic Information Science** **Moderator:** Dr. Muhammad Shafique, National Center of GIS and Space Applications, University of Peshawar, Pakistan		**Class Room 206, Raza Block**
	Panelists	**Organization**	
	Dr. Mark Van Der Meijde, Professor	University of Twente, Netherlands	
	Dr. Fadia Al Wahdah,	Al-Karkh University of Science, Iraq	
	Dr. Ali Nouh Ali Ma'bdeh	Al - Bayt University, Jordan	
	Dr. Mounkaila Mohamed	University Abdou Moumouni Niamey, Niger	
	Dr. Muhammad Adnan Shahid	ARSL, NCGSA, University of Agriculture, Faisalabad, Pakistan	
	Dr. Zia ul Haq	RSGCRL, NCGSA, University of the Punjab, Pakistan	

0915 - 1100	**Technical Session: Satellite Technology** **Chair:** Professor Dr. Khurram Khursheed, Institute of Space Technology, Pakistan **Co Chair:** Dr. Muhammad Rizwan Mughal, Institute of Space Technology, Pakistan **Coordinator:** Naba Ahmad, Institute of Space Technology, Pakistan			**Class Room 207, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
0915 - 0940	Keynote	Laser Communications for Next Generation SATCOM	Dr. Ali Javed Hashmi	Air University, Islamabad, Pakistan
0940 - 1000	2-ST-10	Analysis and Comparison of Maximum Power Point Tracking Algorithms for Electrical Power System of CubeSats	Usman Azeem	Institute of Space Technology, Pakistan
1000 - 1020	2-ST-11	High Performance On-Board Computer Architecture of ICUBE-N	Arooj Shafique	Small Satellite Technology & Research Lab, NCGSA, IST, Pakistan
1020 - 1040	2-ST-6	Attitude Estimation & Control of a CubeSat Using Linear Quadratic Gaussian Approach	Hoor Bano	Institute of Space Technology, Pakistan
1040 - 1100	2-ST-16	Design and Simulation of Cost-efficient Reaction Wheel for 1U CubeSat	Oscar Loinel	GNSS and Space Education Research Lab, NCGSA, IST, Pakistan
0915 - 1100	**Technical Session: Geographic Information Science** **Chair:** Ms. Maria Zubair, Punjab Information Technology Board, Pakistan **Co Chair:** Ms. Aneeqa Abrar, Institute of Space Technology, Pakistan **Coordinator:** Qaiser Abbas, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
0915 - 0940	Keynote	Vulnerability of Pakistan to Climate Change Hazards	Dr. Salar Ali	University of Baltistan, Pakistan
0940 - 1000	5-GIS-6	Accessibility Analysis of Fire Brigade Vehicles by Using Geospatial Techniques. (A Case Study Of Lahore)	Maham Irfan	University of the Punjab, Pakistan
1000 - 1020	5-GIS-10	Targeting Mineral Resources by Using Remote Sensing Techniques and Field Data in District Lower Dir, Northwest Khyber Pakhtunkhwa, Pakistan	Nazir Ul Islam	Chang'an University, China
1020 - 1040	5-GIS-12	Uplifting Agriculture through ICT and Geospatial Applications: A Review of Potential Tools and Techniques	Saif Ullah Khan	Agricultural & Remote Sensing Lab, NCGSA, UAF, Pakistan
1040 - 1100	5-GIS-15	Geospatial Application of Groundwater Quality Index for Lahore Metropolitan, Pakistan: A Retrospective Approach	Syeda Saleha Fatim Ali	Centre for Water Informatics & Technology, Lahore University of Management Sciences, Pakistan
0915 - 1100	**Technical Session: Space Law, Management & Outreach** **Chair:** Dr. Abdul Waheed, Institute of Space Technology, Pakistan **Co Chair:** Mr. Hamza Hameed, Space Generation Advisory Council, Austria **Coordinator:** Laiba Ejaz, Institute of Space Technology, Pakistan			**Class Room 6229, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
0915 - 0940	Keynote	Space Law and Policy Predicament: A Case Study of South Asia	Dr. Rubina Waseem	National Defence University, Pakistan
0940 - 1005	Keynote	International Law for The Space Sector: Do International Instruments Promote Growth and Development for The Space Industry?	Mr. Hamza Hameed	Space Generation Advisory Council, Austria
1005 - 1025	10-SLMO-3	Legal Regimes and the Issue of Weaponization of Outer Space	Munazza Khalid	Air University, Islamabad, Pakistan, Quaid-I-Azam University, Islamabad, Pakistan
1025 - 1045	10-SLMO-1	Strategizing Pakistan's Space Policy for Defensive Discourse: A Case Study of Pulwama-Balakot Crisis	Noor Ul Huda Atif	National University of Sciences and Technology, Pakistan
1045 - 1105	10-SLMO-4	Space Weaponization: Challenges and Ramification for International Security	Munazza Khalid	Air University, Islamabad, Pakistan, Quaid-I-Azam University, Islamabad, Pakistan
0930 - 1800	**Workshop on Geomagnetism & Ionosphere** *Organized by ISNET*			**Main Computer Lab, Farooque Block**
1100 - 1130	**Coffee / Networking Break**			**Eatery - Side Lawn**

0940 - 1005	Keynote	International Law for The Space Sector: Do International Instruments Promote Growth and Development for The Space Industry?	Mr. Hamza Hameed	Space Generation Advisory Council, Austria
1005 - 1025	10-SLMO-3	Legal Regimes and the Issue of Weaponization of Outer Space	Munazza Khalid	Air University, Islamabad, Pakistan, Quaid-I-Azam University, Islamabad, Pakistan
1025 - 1045	10-SLMO-1	Strategizing Pakistan's Space Policy for Defensive Discourse: A Case Study of Pulwama-Balakot Crisis	Noor Ul Huda Atif	National University of Sciences and Technology, Pakistan
1045 - 1105	10-SLMO-4	Space Weaponization: Challenges and Ramification for International Security	Munazza Khalid	Air University, Islamabad, Pakistan, Quaid-I-Azam University, Islamabad, Pakistan
0930 - 1800	**Workshop on Geomagnetism & Ionosphere** *Organized by ISNET*			**Main Computer Lab, Farooque Block**
1100 - 1130	**Coffee / Networking Break**			**Eatery - Side Lawn**
1250 - 1310	Renewable Energy (Wind and Solar) Recourse Potential of Pakistan Using GIS based Multicriteria Analysis		Dr. M. Farooq Ahmed	University of Engineering & Technology, Lahore, Pakistan
1130 - 1300	**Forum 360: STEM Education** **Moderator:** Mr. Danial Amin, Space Technology Education and Popularization, Pakistan Mr. Faaiz Ahmed Jeelani, National Center of GIS & Space Applications, Pakistan			**Class Room 206, Raza Block**
	Panelists		**Organization**	
	Dr. Alim Rüstem Aslan, Professor		Istanbul Technical University, Turkey	
	Dr. Christine Amory Mazaudier		Institut Polytechnique de Paris, France	
	Dr. Andris Slavinskis		UT Tartu Observatory, Estonia	
	Dr. Ali Nouh Ali Ma'bdeh		Al - Bayt University, Jordan	
	Dr. Najam Abbas Naqvi		National Center of GIS & Space Applications, Institute of Space Technology, Pakistan	
	Dr. Abdul Waheed		National Center of GIS & Space Applications, Institute of Space Technology, Pakistan	
	Dr. S. Zaineb Farooq		Institute of Space Technology, Pakistan	
1130 - 1300	**Technical Session: Aeronautics & Astronautics** **Chair:** Dr. Adnan Maqsood, National University of Sciences & Technology, Pakistan **Co Chair:** Muhammad Nadeem Khan, Institute of Space Technology, Pakistan **Coordinator:** Baheej Sajjad, Institute of Space Technology, Pakistan			**Class Room 207, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1130 - 1150	1-AA-18	Nose Landing Gear Conceptual Design and Analysis for M.A.L.E U.C.A.V	Asim Mehmood	Institute of Space Technology, Pakistan
1150 - 1210	1-AA-7	Review On Advance Seaplane Conceptual Design Adapting Trimaran Boat Hull Concept	Khizar Ahmad Baqai	Superior University, Pakistan
1210 - 1230	1-AA-24	Generalised Modelling of Sound Signatures for Characterization of Multi-copter Unmanned Air Vehicles Based on Aero-acoustics Measurements and CFD Analysis	Syed Saddam Ul Hassan	Air University, Kamra, Pakistan
1230 - 1250	1-AA-32	CFD Analysis of Multi-Element Natural Laminar Flow Airfoil NLF(1)-0115 for a Fixed-Wing UAV	Absar Ahmed Khan	University of Karachi, Pakistan
1250 - 1310	8-APM-1	Innovative Aerodynamic Design of Passenger Car for Low Power Consumption	Muhammad Husnain	Air University, Islamabad Pakistan
1130 - 1300	**Technical Session: Astronomy, Astrophysics & Astrobiology** **Chair:** Professor Dr. Muhammad Ali Ismail, NED University of Engineering and Technology, Pakistan **Co Chair:** Dr. Fazeel Mahmood Khan, Institute of Space Technology, Pakistan **Coordinator:** Zilal Shakeel, Institute of Space Technology, Pakistan			**Video Conference Room, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**

1130 - 1155	Keynote	The Impact of Trends in South Asia Low Pressure Center on North Indian Ocean Air-Sea Heat Fluxes	Dr. Muhammad Jawed Iqbal	Institute of Space Science & Technology, University of Karachi, Pakistan
1155 - 1215	9-AAA-6	Event Rate Of Extreme Mass Ratio Inspiral Systems in M32 Galaxy	Muhammad Waqas	Institute of Space Technology, Pakistan
1215 - 1235	9-AAA-8	Gamma-ray Burst High-latitude Emission: Simulating the Propagation Effect	Khadeejah Motiwala	Space & Astrophysics Research Lab, NCGSA, IST, Pakistan
1235 - 1255	9-AAA-11	The Spectral Parameters of Gamma-Ray Blazars	Muhammad Shahzad Anjum	Xiamen University, Malaysia
1130 - 1300	**Technical Session: Satellite Technology** **Chair:** Dr. Qamar ul Islam, Institute of Space Technology, Pakistan **Co-Chair:** Dr. Rizwan Mughal, Institute of Space Technology, Pakistan **Coordinator:** Hadia Faisal, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1130 - 1155	Keynote	The Floating Satellite System as an Educational Platform for Space Applications	Dr. Muhammad Kamran Saleem	University of Central Punjab, Pakistan
1155 - 1215	2-ST-12	Formation Flying Strategy for Attitude Determination and Control of CubeSat	Muhammad Abubakar Arshad	Institute of Space Technology, Pakistan
1215 - 1235	2-ST-13	ICUBE-N: National CubeSat of Pakistan	Usman Imran	Small Satellite Technology & Research Lab, NCGSA, IST, Pakistan
1235 - 1255	2-ST-14	Dynamic Analysis of 3U iPOD Structure	Muhammad Asfandyar	Small Satellite Technology & Research Lab, NCGSA, IST, Pakistan
1130 - 1300	**Technical Session: Positioning, Navigation & Timing** **Chair:** Dr. Tahir Saleem, Women University Swabi, Pakistan **Co Chair:** Dr. Munawar Shah, Institute of Space Technology, Pakistan **Coordinator:** Abdullah Yousaf, Institute of Space Technology, Pakistan			**Class Room 6229, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1130 - 1155	Keynote	Multi-Constellation and Multi-Frequency GNSS Positioning using Environment Context Detection	Dr. Arslan Ahmed	National Skills University, Islamabad
1155 - 1215	4-PNT-5	GNSS TEC Based Ionospheric Anomalies Related to The 2019 Mw 6.2 Thailand Earthquake	Shireen Mushtaq	Institute of Space Technology, Pakistan
1215 - 1235	4-PNT-7	Investigation of Ionospheric Scintillation using BeiDou during Geomagnetic and Non-geomagnetic Storm Conditions Over Pakistan	Hina Magsi	Sukkur Institute of Business Administration University, Pakistan
1235 - 1255	4-PNT-10	Investigation of Pre-Seismic Ionospheric and Atmospheric Anomalies before Mw 6.1 El Salvador Earthquake on October 28, 2018	Abdur Rafeh Abbasi	Institute of Space Technology, Pakistan
1300 - 1415	**Luncheon: Networking & Prayer Break**			**Eatery - Side Lawn**
1415 - 1600	**Science Diplomacy Session** **Chair & Moderator:** Mr. Sayyed Paras Ali, Technology Times, Pakistan			**Auditorium, Raza Block**
	Title of Presentation		**Speaker**	**Organization**
1415 - 1440	TBD		Mr. Manzoor H. Soomro, President	ECO Science Foundation (ECOSF), Pakistan
1440 - 1505	TBD		Mr. Guangnian Wang	Zhejiang Science and Technology Association, China
1505 - 1530	Science Diplomacy: An Evolving Framework		Dr. Imtinan Elahi Qureshi	Pakistan Nuclear Society
1530 - 1555	Role of "Space Sciences" in Science & Technology Diplomacy		Prof. Dr. Muhammad Ali Ismail	NED University of Engineering and Technology, Pakistan
1555 - 1615	The role of Science Communication and Popularization for Science Diplomacy		Mr. Sayyed Paras Ali	Technology Times, Pakistan

1415 - 1600	**Technical Session: Aeronautics & Astronautics** **Chair:** Professor Dr. Zuabir Khan, Institute of Space Technology, Pakistan **Co Chair:** Dr. Naseem Ahmad, Institute of Space Technology, Pakistan **Coordinator:** Naba Ahmad, Institute of Space Technology, Pakistan			**Class Room 207, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	1-AA-12	Design & Development of Static-Thrust Test-Bench for Aviation Based Piston Engines	Syed Muhammad Basit Ali	University of Management and Technology, Pakistan
1435 - 1455	1-AA-36	An Overview of Passive Flow Control Techniques in Supersonic Flows	Zukhruf Liaqat	National University of Sciences and Technology, Pakistan
1455 - 1515	2-ST-3	Design And Development Of A High Precision Thrust Measurement System	Muzamil Ali	Pakistan Institute of Engineering and Applied Sciences, Pakistan
1515 - 1535	8-APM-5	Simulations Of Thin Gray Fluid Over A Moving Flat Plate	Sadia Maryam	National University of Sciences and Technology, Pakistan
1535 - 1555	8-APM-10	Design, Analysis and Fabrication of a Hydro Vortex Turbine	Usman Ahmad	Institute of Space Technology, Pakistan
1415 - 1600	**Technical Session: Environment & Climate Science (Smart Farming)** **Chair:** Dr. Muhammad Adnan Shahid, National Center of GIS and Space Applications, University of Agriculture, Faisalabad, Pakistan **Co Chair:** Dr. Salar Ali, University of Baltistan, Pakistan **Coordinator:** Baheej Sajjad, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	7-ECS-3	Prototype of an Autonomous Farming Robot: A Smart Farming System.	Moaz Ahmad	Superior University, Pakistan
1435 - 1455	7-ECS-9	Autonomous Unmanned Aerial Vehicle for Agricultural, Security, Emergency and Other Uses	Dr. Amir Rashid Anjum	FAMBZZHH, Islamabad, Pakistan
1455 - 1515	3-ICT-9	Promoting Sustainable Cotton Production through smart farm advisory based on remote sensing and advancements in Machine learning & Artificial Intelligence	Dr. Salman Qadri	Muhammad Nawaz Sharif University of Agriculture Multan, Pakistan
1415 - 1600	**Technical Session: Remote Sensing & Photogrammetry** **Chair:** Dr. Dostdar Hussain, Karakoram International University, Pakistan **Co Chair:** Ms. Maria Zubair, Punjab Information Technology Board, Pakistan **Moderator:** Tooba, Institute of Space Technology, Pakistan			**Class Room 6229, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	6-RSP-5	Implementation Of The Maximum Cross Correlation (MCC) Method In Python For Ocean Current Estimation Over The Arabian Sea	Sheeza Khalid	Institute of Space Technology, Pakistan
1435 - 1455	6-RSP-2	Machine Learning Based Thermal Anomaly Detection Associated with Three Earthquakes in Pakistan Using MODIS LST	Amna Hafeez	GNSS and Space Education Research Lab, NCGSA, IST, Pakistan
1455 - 1515	6-RSP-7	Deep Learning Based Radar Target Classification Using Micro-Doppler Features	Ali Hanif	National University of Sciences and Technology, Pakistan
1515 - 1535	3-ICT-13	Campus Terrain Surveying and Mapping using Low Range 2D Laser Scanners	Syed Riaz Un Nabi Jafri	NED University of Engineering and Technology, Pakistan
1415 - 1600	**Technical Session: Information & Communication Technologies** **Chair:** Dr. Farrukh Aziz Bhatti, Institute of Space Technology, Pakistan **Co Chair:** Dr. Syed Ali Irteza, Institute of Space Technology, Pakistan **Coordinator:** Laiba Ejaz, Institute of Space Technology, Pakistan			**Class Room 6228, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1440	Keynote	The 6G Wireless Networks: What to Expect and How to Excel	Dr. Syed Ali Hassan	National University of Science and Technology, Pakistan
1440 - 1500	4-PNT-3	Parameter Identification and Optimization of Permanent Magnet DC Motor using Nonlinear Least Square Error Method	Raja Muhammad Sohail Khan	National University of Sciences and Technology, Pakistan
1500 - 1520	6-RSP-1	Unsupervised Classification of Hyperspectral Images using PCA and K-Means	Ayesha Malik	GNSS and Space Education Research Lab, NCGSA, IST, Pakistan

1520 - 1540	3-ICT-11	Sentiment Analysis Of Social Media Text For Selective World Events And Geographical Segregation	Muhammad Ahsan Khan	Institute of Space Technology, Pakistan
1600 - 1745	**Summit on Geographic Information Science & Space Applications** **Chair & Moderator:** Dr. Najam Abbas Naqvi, National Center of GIS and Space Applications, Institute of Space Technology, Pakistan			**Auditorium, Raza Block**
	Presentations Scope		**Speaker**	**Organization**
1600 - 1615	Geo-Forensic and Geo-Health Component of Spatial Decision Support System Lab, National Center of GIS and Space Applications, Pakistan		Dr. Syed Attique Shah	Balochistan University of Information Technology, Engineering and Management Sciences, Pakistan
1615 - 1630	Mineral Inventory Component of Spatial Decision Support System Lab, National Center of GIS and Space Applications, Pakistan		Dr. Rabia Zafar	Sardar Bahadur Khan Women University, Pakistan
1630 - 1645	Space & Astrophysics Research Lab, National Center of GIS and Space Applications, Pakistan		Dr. Saeeda Sajjad	Institute of Space Technology, Pakistan
1645 - 1700	GNSS and Space Education Research Lab, National Center of GIS and Space Applications, Pakistan		Dr. Abdul Waheed	Institute of Space Technology, Pakistan
1700 - 1715	Small Satellite Technology & Research Lab, National Center of GIS and Space Applications, Pakistan		Dr. Rehan Mahmood	Institute of Space Technology, Pakistan
1715 - 1730	Agriculture Remote Sensing Lab, National Center of GIS and Space Applications, Pakistan		Dr. Muhammad Adnan Shahid	University of Agriculture Faisalabad, Pakistan
1730 - 1745	GIS and Space Applications in Geosciences Lab, National Center of GIS and Space Applications, Pakistan		Dr. Muhammad Shafique	University of Peshawar, Pakistan
1745 - 1800	Forest Resource Assessment Component of GIS and Space Applications in Geosciences Lab, National Center of GIS and Space Applications, Pakistan		Dr. Sami Ullah Dawar	Shaheed BB University, Sheringal, Pakistan
1800 - 1815	Remote Sensing, GIS and Climatic Research Lab, National Center of GIS and Space Applications, Pakistan		Dr. Zia ul Haq	University of the Punjab, Pakistan
1600 - 1740	**Technical Session: Aeronautics & Astronautics (Material Sciences)** **Chair:** Dr. Wilayat Hussain, Institute of Space Technology, Pakistan **Co Chair:** Dr. Abdul Basit Saim, Institute of Space Technology, Pakistan **Coordinator:** Hadia Faisal, Institute of Space Technology, Pakistan			**Class Room 207, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1600 - 1620	1-AA-3	Recent Advancements in Thermal Barrier Coatings (TBC) for High-Temperature Gas Turbines	Osama Ali Ahmed Awan	Air University, Islamabad, Pakistan
1620 - 1640	1-AA-1	Application Of Lotus Root Bionic Structure For Increment In Impact Load Bearing Capability Of A Satellite's Return Capsule	Obaid Ur Rehman	Beihang University, China
1640 - 1700	8-APM-9	Normal and Oblique Ballistic Impact on Monolithic 5083 Aluminum Plate	Shafqat Hussain	Heavy Industries Taxila Education City, Pakistan
1700 - 1720	7-ECS-7	Investigations of Mechanical Properties of Sn-3.5Ag-0.5La Lead-Free Solder Alloy for Green Electronics	Fahad Sagheer	University of Engineering and Technology, Peshawar, Pakistan
1720 - 1740	8-APM-7	Design, Analysis And Fabrication Of Composite Curing Compressive Mold For Aerospace Application	Sabih Ahmad Khan	National University of Sciences and Technology, Pakistan
1600 - 1745	**Research Poster Display**			**Exposition Arena, Raza Block**
1930 - 2130	**Visit to Shopping Mall & Dinner** *(by invitation only)*			**DHA - II, Islamabad**

Day 3

Thursday, December 16, 2021

Day 3, Thursday, December 16, 2021			
Time (PKT) Hours	**Program**		**Venue**
1030 - 1100	**Session on Space Science, Technology & its Applications for Socio-economic Development** *(by invitation only)*		**Auditorium, Raza Block**
	Moderator: Dr. Najam Abbas Naqvi, Institute of Space Technology, Pakistan		
1100 - 1130	**Research Poster & Product Display**		**Exposition Arena, Raza Block**
1130 - 1145	**Coffee / Networking Break**		**Eatery - Side Lawn**
1145 - 1310	**Plenary Session: Aeronautics & Astronautics**		**Auditorium, Raza Block**
	Chair: Dr. Syed Hossein Raza Hamdani, Institute of Space Technology, Pakistan **Co Chair & Moderator:** Dr. Muhammad Farooq Haydar, Institute of Space Technology, Pakistan		
	Title of Presentation	**Speaker**	**Organization**
1130 - 1150	The Role of Artificial Intelligence in Spacecraft Guidance, Navigation, and Control	Dr. Tamer Mekky Ahmed Habib	The National Authority of Remote Sensing and Space Sciences, Egypt
1150 - 1210	Introduction to ADS-B- Technology and its Implementation in Pakistan Airspace	Engr. Muhammad Asad Khan Nizai	Pakistan Civil Aviation Authority
1210 - 1230	Application of Computational Intelligence Techniques for Sub-Orbital Vehicle Design	Dr. Ali Sarosh	Air University, Islamabad, Pakistan
1230 - 1250	Generalized Dynamic Inversion Control: Achievements and Opportunities	Dr. Abdulrahman H. Bajodah	King Abdulaziz University, Saudi Arabia
1250 - 1310	Wavelet Threshold de-noising Method to Reduce the Noise of Raw Data for Flight Data	Dr. Chen Jie	Northwestern Polytechnical University, China
1145 - 1330	**STEP Stakeholders' Forum**		**Video Conference Room, Raza Block**
	Moderator: Dr. Najam Abbas Naqvi, National Center of GIS & Space Applications, Institute of Space Technology, Pakistan		
	Organization	**Speaker**	
1145 - 1200	Space Education and Awareness Drive, SUPARCO, Pakistan	Lt. Col Abid Ali (Division Head SEAD, SUPARCO)	
1200 - 1215	Space Education Research Lab, National Center of GIS and Space Applications, Pakistan	Dr. Abdul Waheed (Lab Director)	
1215 - 1230	Lahore Astronomical Society, Pakistan	Mr. Umair Asim (President LAS)	
1230 - 1245	Explorations by Yumna, Pakistan	Yumna Majeed (Founder & CEO)	
1245 - 1300	Cosmic Space Systems, Pakistan	Mr. Ahmad Kamal Janjua (Founder & CEO)	
1300 - 1315	Oxbridge Innovative Solutions, Pakistan	Ms. Manzil e Maqsood (Founder & CEO)	
1315 - 1330	Rah-e-Qamar, Pakistan	Mr. Mohammad Iftekhar Yezdani (Co-Founder)	
1330 - 1345	Astrobiology Network of Pakistan, Pakistan	Mr. Syed Muneeb Ali (Member)	
1345 - 1400	Space Technology Education and Popularization	Mr. Danial Amin (Chief Technology Officer)	

1145 - 1300	**Panel Discussion: Space Weather and GNSS** **Moderator:** Ms. Maria Mehmood, National University of Sciences and Technology, Pakistan			**Class Room 206, Raza Block**
	Panelists		**Organization**	
	Dr. Christine Amory Mazaudier		Institut Polytechnique de Paris, France	
	Dr. Andres Calabia Aibar		Universidad Politécnica de Madrid, Spain	
	Dr. Muhsan Ehsan		Bahria University, Pakistan	
	Mr. M. Ayyaz Ameen		Pakistan Space and Upper Atmosphere Research Commission	
	Dr. Munawar Shah		Institute of Space Technology, Pakistan	
1145 - 1800	**Workshop on Optical Remote Sensing & Geographic Information Science** *Dr. Muhammad Shafique - National Center of GIS and Space Applications, Pakistan*			**Geospatial Research and Education Lab, Raza Block**
1145 - 1325	**Technical Session: Information & Communication Technologies** **Chair:** Associate Professor Dr. Syed Amer Gilani, Institute of Space Technology, Pakistan **Co Chair:** Assistant Professor Dr. Madiha Tahir, Institute of Space Technology, Pakistan **Coordinator:** Hashim Khan, Institute of Space Technology, Pakistan			**Class Room 6228, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1145 - 1205	**Keynote**	**Software Reliability Requirements for Mission and Safety Critical Systems**	**Dr. M. Uzair Khan**	**National University of Computer and Emerging Sciences, Pakistan**
1205 - 1225	3-ICT-3	Comparative Study of Image to Image Translation Models for Abnormal Weather Effects Removal	Maria Siddiqua	Pakistan Institute of Engineering and Applied Sciences
1225 - 1245	3-ICT-6	Blockchain Based RFID Prototype For Medicine Traceability along the Healthcare Supply Chain	Afaq Ahmed	Bahria University, Pakistan
1245 - 1305	3-ICT-10	An In-data Network Intrusion Detection by Employing Machine Learning Algorithms	Muhammad Nadeem Yousaf	Institute of Space Technology, Pakistan
1305 - 1325	3-ICT-15	Autonomous Drone Navigation using Deep Convolutional Neural Network	Muhammad Arif Arshad	Pakistan Institute of Engineering and Applied Sciences
1145 - 1300	**Technical Session: Positioning, Navigation & Timing** **Chair:** Dr. S. Zaineb Farooq, Institute of Space Technology, Pakistan **Co Chair:** Mr. Syed Fawad Zulfiqar **Coordinator:** Zillal Shakeel, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1145 - 1205	1-AA-30	Resolution Improvement In GNSS Based Synthetic Aperture Radar Using GPS L1 Signals From Multiple Satellites And Different Look Angles	Muhammad Shoaib Ul Hassan	Institute of Space Technology, Pakistan
1205 - 1225	4-PNT-2	Analysis and Estimation of Zenith Wet Delay and Zenith Tropospheric Total Delay at Earth's different Geographical Areas	Jabir Shabbir Malik	Beijing Institute of Technology, China
1225 - 1245	4-PNT-4	Threats to the Navigation of Drone Based Delivery System	Imtiaz Nabi	GNSS and Space Education Research Lab, NCGSA, IST, Pakistan
1245 - 1305	6-RSP-11	Modeling & Simulation of BSAR (Bi Static Synthetic Aperture Radar) system using Reflected BeiDou B1i Signals	Hassan Sadiq	Institute of Space Technology, Pakistan
1145 - 1300	**Technical Session: Remote Sensing & Geographic Information Science** **Chair:** Dr. Ali Nouh Ali Ma'bdeh, Al - Bayt University, Jordan **Co Chair:** Dr. Fadia W. Al-Azawi, Al-Karkh University of Science, Iraq **Coordinator:** Naba Ahmad, Institute of Space Technology, Pakistan			**Class Room 6229, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**

1145 - 1205	5-GIS-8	Probabilistic Assessment of Storm Surge Hazard along Coastal Regions of Sindh Province, Pakistan	Hadiqa Khan	Pakistan Space & Upper Atmosphere Research Commission
1205 - 1225	5-GIS-14	Improving Polio Vaccination Exposure in Pakistan using Geospatial Analysis	Syed Attique Shah	Spatial Decision Support Systems Lab, NCGSA, BUITEMS, Pakistan
1225 - 1245	5-GIS-9	Developing Heat Index for Heat Wave Hazard Mapping: A Case Study of Sindh Province, Pakistan	Yusha Anis	Pakistan Space & Upper Atmosphere Research Commission
1245 - 1305	6-RSP-8	Deep Learning on High Spatial and Temporal Cadence Satellite Imagery for Field Boundary Delineation	Syed Roshaan Ali Shah	Pakistan Space & Upper Atmosphere Research Commission
1300 - 1415	**Luncheon: Networking & Prayer Break**			**Eatery - Side Lawn**
1415 - 1600	**Space Science & Technology Cooperation Session** **Moderator:** Mr. Sohaib Ahmed, National Center of GIS and Space Applications, Pakistan			**Auditorium, Raza Block**
	Organization		**Speaker**	
1415 - 1435	Belt and Road Aerospace Innovation Alliance, China		Prof. Dr. Chen Jun (Deputy Director)	
1435 - 1455	Space Generation Advisory Council, Austria		Mr. Hamza Hameed (Legal Team Lead)	
1455 - 1515	Asia-Pacific Space Cooperation Organization, China		Ms. Aisha Jagirani (Director General)	
1515 - 1535	Islamic World Educational, Scientific and Cultural Organization (ICESCO), Morocco		Dr. Muhammad Sharif (Advisor Science & Technology)	
1415 - 1600	**Panel Discussion: Satellite Technology** **Moderator:** Dr. Rehan Mehmood, National Center of GIS and Space Applications, Institute of Space Technology, Pakistan			**Class Room 206, Raza Block**
	Panelists		**Organization**	
	Dr. Alim Rüstem Aslan		Istanbul Technical University, Turkey	
	Dr. Kamran Saleem		University of Central Punjab, Pakistan	
	Dr. Qamar ul Islam		Institute of Space Technology, Pakistan	
	Dr. Rizwan Mughal		Institute of Space Technology, Pakistan	
	Dr. Tamer Mekky Ahmed Habib		The National Authority of Remote Sensing and Space Sciences, Egypt	
1415 - 1600	**Technical Session: Astronomy, Astrophysics & Astrobiology** **Chair:** Muhammad Jawed Iqbal, University of Karachi, Pakistan **Co Chair:** Dr. Saeeda Sajjad, Institute of Space Technology, Pakistan **Coordinator:** Zillal Shakeel, Institute of Space Technology, Pakistan			**Video Conference Room, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	9-AAA-2	Proliferation and survival analysis of rhizosphere soil bacteria in a new Mars soil simulant under Martian Conditions	Behzad Nadeem	Kohat University of Science & Technology, Pakistan
1435 - 1455	9-AAA-1	Libration Points of Space	Hadia Batool	Fazaia Bilquis College of Education, Pakistan
1455 - 1515	9-AAA-4	Deinococcus Radiodurans As A Chassis For Synthetic Biology Experiments In Space Biology	Muneef Ur Rehman	CECOS University of IT and Emerging Sciences, Pakistan

1415 - 1600	**Technical Session: Aeronautics & Astronautics** **Chair:** Dr. Ali Sarosh, Air University, Islamabad, Pakistan **Co Chair:** Dr. Adnan Maqsood, National University of Sciences and Technology, Pakistan **Coordinator:** Abdullah Yousaf, Institute of Space Technology, Pakistan			**Class Room 207, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	1-AA-20	Simulation of Human Cough and Sneeze Discharge in Confined Areas and Effective Ventilation System to Reduce COVID-19 Spread in Confined Areas	Muhammad Anas	National University of Sciences and Technology, Pakistan
1435 - 1455	1-AA-34	Numerical Modeling and Simulation of Liquid Spray Atomization	Maryam Ozair	Pakistan Space & Upper Atmosphere Research Commission
1455 - 1515	1-AA-22	Development of Low Cost Wind Tunnel for Measuring Lift and Drag	Hira Aftab	University of Management and Technology, Pakistan
1515 - 1535	8-APM-6	Estimation of Drag Reduction of a Cargo Tractor-trailer using CFD Analysis in Different Configurations	Muhammad Rashid Liaqat	The Superior University, Pakistan
1535 - 1555	1-AA-8	Modeling and Analysis of a Vibratory Bowl Feeder	Sadia Azhar	Air University, Islamabad, Pakistan
1415 - 1600	**Technical Session: Positioning, Navigation & Timing (Space Weather)** **Chair:** Dr. Christine Marie Eugenie Amory, Institut Polytechnique de Paris, France **Co Chair:** Dr. Salar Ali, University of Baltistan, Pakistan **Coordinator:** Tooba, Institute of Space Technology, Pakistan			**Class Room 218, Raza Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1435	2-ST-1	Possible Seismo-Ionospheric Anomalies Associated With the Earthquakes Occurred in 2018 Using GNSS TEC: A Statistical Analysis	Muhammad Arqim Adil	Institute of Space Technology, Pakistan
1435 - 1455	4-PNT-9	Performance Analysis of Global Ionosphere/TEC Models over Islamabad	Usama Ahmed	Institute of Space Technology, Pakistan
1455 - 1515	2-ST-2	Possible ionospheric anomalies associated with 2019 Mw 5.4 Mirpur, Pakistan Earthquake from Swarm satellites	Muhammad Sibtain Satti	Institute of Space Technology, Pakistan
1515 - 1535	9-AAA-9	Storm time ionospheric variations from GNSS TEC and Swarm satellites	Muhammad Taimur Khan	Institute of Space Technology, Pakistan
1535 - 1555	2-ST-4	Analysis Of Atmospheric Anamolies Associated With Mw>6.0 Continental Earthquake In Afghanistan And Tajkistan	Daboor Sultana	Institute of Space Technology, Pakistan
1415 - 1600	**Technical Session: Applied Physics and Mathematics** **Chair:** Dr. Salman Ahmad, Institute of Space Technology, Pakistan **Co Chair:** Dr. Rahila Naz, Institute of Space Technology, Pakistan **Coordinator:** Laiba Ejaz, Institute of Space Technology, Pakistan			**Class Room 6229, Farooque Block**
	Paper ID	**Title of Presentation**	**Speaker**	**Organization**
1415 - 1440	Keynote	**Reduced Basis Methods for Parametrized Partial Differential Equations: A Stable and Less Expensive Approach**	**Dr. Shafqat Ali**	**Ghulam Ishaq Khan Institute of Engineering Sciences and Technology**
1440 - 1500	8-APM-2	RBF-PS method to examine eventual periodicity of linearized KdV Equation	Asma Norin	University of Science and Technology Bannu, Pakistan
1500 - 1520	1-AA-4	Mathematical Modelling and Analysis of Submarine Propeller Shaft	Obeid Muhammad Usmani	Air University, Islamabad, Pakistan
1520 - 1540	8-APM-3	Simulations For Boundary Layer Flows And Heat Transfer of Cross Fluid Over A Moving Flat Plate	Mazhar Shehzad	National University of Sciences and Technology, Pakistan
1540 - 1600	1-AA-31	Evaluation Of Flight Mechanics Performance of A Fighter Aircraft Using Computational Fluid Dynamics	Asra Imtiaz	Institute of Space Technology, Pakistan
1600 - 1700	**Closing Ceremony & Farewell Tea**			**Auditorium, Raza Block**
1930 - 2130	**Cultural Visit, Sightseeing and Farewell Dinner** *(by invitations only)*			**Lok Virsa, Pakistan Monument & Monal**

Seventh International Conference On

AEROSPACE SCIENCE & ENGINEERING

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Institute of Space Technology

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Dr. S. Zaineb Farooq Dr. Farooq Hayder	*Assistant Professor* *Dept. of Avionics Engineering, IST* *Assistant Professor* *Dept. of Aeronautics and Astronautics, IST*	Positioning, Navigation & Timing
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Dr. Salman Ahmad Dr. Fazeel Mehmood Khan	*Head of Department* *Applied Mathematics and Statistics, IST* *Associate Professor* *Dept. of Space Science, IST*	Applied Physics & Mathematics
Dr. Saeeda Sajjad Dr. Imran Khan	*Principal Investigator/ Lab Director* *Space & Astrophysics Research Lab, NCGSA* *Assistant Professor* *Dept. of Space Science, IST*	Astronomy, Astrophysics & Astrobiology
Ms. Ayesha Jagirani Dr. Ausima Sultan Malik Dr. Ayesha Bukhari	*Asia Pacific Space Cooperation Organization, China* *Head of Department* *Humanities Department, IST* *Assistant Professor* *Dept. of Humanities, IST*	Space Law, Management & Outreach

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Institute of Space Technology

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CECOS University of IT and Emerging Sciences, Pakistan	College of Aeronautical Engineering, NUST, Risalpur, Pakistan	Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, Pakistan	HITEC University, Pakistan

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Star Gazing Session	
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General Information

Institute of Space Technology

a. Islamabad, Pakistan

The capital city of Pakistan, is one of the most beautiful cities in the South Asian region. Built in the 1960s to replace Karachi as Pakistan's capital, the city of Islamabad offers has evolved at a tremendous pace. Wide, tree-lined streets adorn the well-planned sectors and zones of the city, making it easily accessible and spectacular for living. A meticulously planned city surrounded by breathtaking views of Margalla Hills - Islamabad is the fastest growing city in terms of population, economy and urban development. The city holds heritage of rich history, showcased through museums and other historical sites.

b. Weather

Tue 14 | Day

18°

1%
W 10 km/h

Sunshine and clouds mixed. Hazy. High 18C. Winds W at 10 to 15 km/h.

Record High --	Average High 19°
Sunrise 7:04 am	Sunset 5:00 pm

Tue 14 | Night

6°

2%
ESE 9 km/h

A few clouds. Hazy. Low 6C. Winds light and variable.

Record Low --	Average Low 5°
Moonrise 2:08 pm	Moonset 2:29 am
Waxing Gibbous	

Wed 15 | Day

19°

3%
W 11 km/h

Sunny. Hazy. High 19C. Winds W at 10 to 15 km/h.

Record High --	Average High 19°
Sunrise 7:04 am	Sunset 5:00 pm

Wed 15 | Night

6°

10%
ENE 10 km/h

Clear. Hazy. Low 6C. Winds light and variable.

Record Low --	Average Low 5°
Moonrise 2:36 pm	Moonset 3:25 am
Waxing Gibbous	

Thu 16 | Day

19°

5%
W 11 km/h

Sunshine. Hazy. High 19C. Winds W at 10 to 15 km/h.

Record High --	Average High --
Sunrise 7:05 am	Sunset 5:01 pm

Thu 16 | Night

6°

9%
E 10 km/h

Clear to partly cloudy. Hazy. Low 6C. Winds light and variable.

Record Low --	Average Low --
Moonrise 3:06 pm	Moonset 4:22 am
Waxing Gibbous	

c. Time Zones

Serial No.	Country	UTC- Time	Time difference
01	Turkey	UTC+3 Hours	Pakistan is 2 hours ahead of Turkey
02	France	UTC+1 Hour	Pakistan is 4 hours ahead of France
03	Egypt	UTC+2 Hours	Pakistan is 3 hours ahead of Egypt
04	Spain	UTC+ 1 Hour	Pakistan is 4 hours ahead of Spain
05	Latvia	UTC+ 2 Hours	Pakistan is 3 hours ahead of Latvia
06	Jordan	UTC+ 2 Hours	Pakistan is 3 hours ahead of Latvia
07	Indonesia	UTC+ 8 Hours	Indonesia is 3 hours ahead of Pakistan
08	Italy	UTC+ 1 Hour	Pakistan is 4 hours ahead of Italy
09	Belgium	UTC+ 1 Hour	Pakistan is 4 hours ahead of Belgium
10	Niger	UTC+ 1 Hour	Pakistan is 4 hours ahead of Nigeria
11	Iraq	UTC+ 3 Hours	Pakistan is 2 hours ahead of Iraq
12	Netherlands	UTC+ 1 Hour	Pakistan is 4 hours ahead of Netherlands

d. Currency Exchange

As a major airport connecting all corners of the globe, Islamabad International Airport has several exchange bureaus in all terminals, so you can get the right currency for your destination. Following currency exchange services are available at Islamabad International Airport:

- Royal International Exchange
- Muhammadi Exchange
- National Bank of Pakistan Exchange

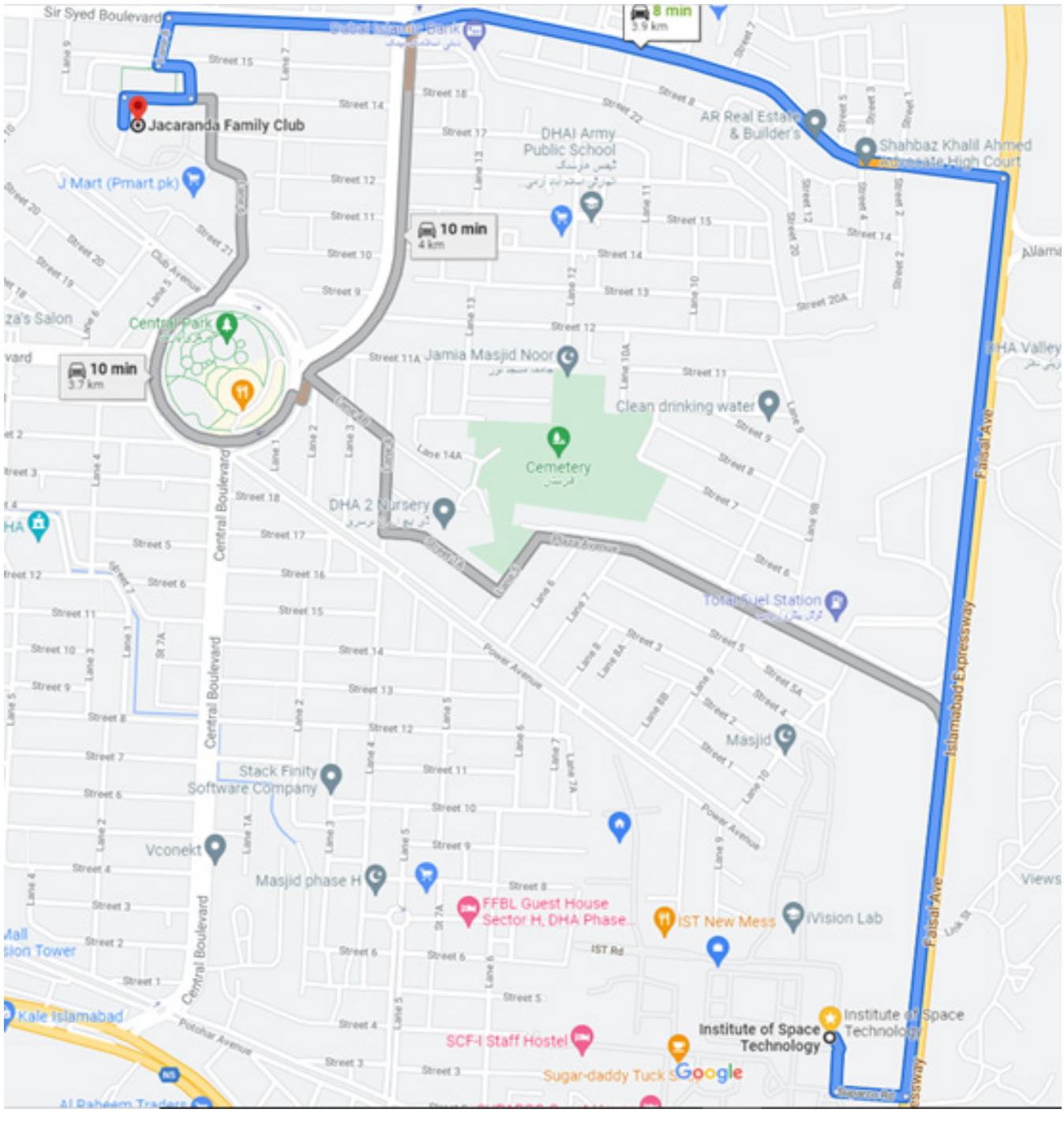
Following are the exchange rates of different currencies:

Note: Following rates are taken on December 02, 2021. Currency exchange rates may vary overtime.

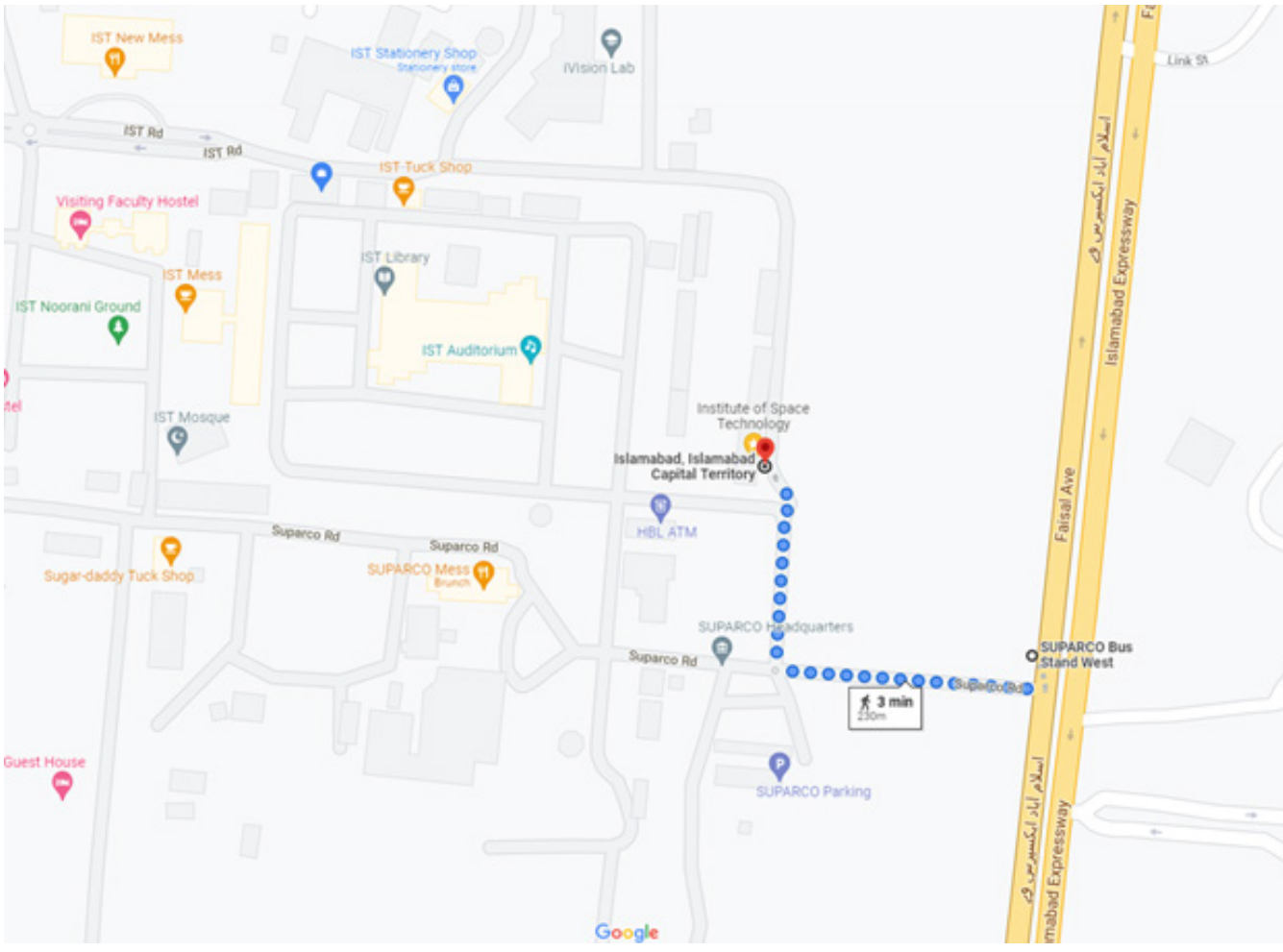
COUNTRY	CURRENCY	EXCHANGE RATE
Turkey	Lira	1 Turkish Lira = 13.0 PKR
France	Euro	1 Euro = 198.7 PKR
Egypt	Egyptian Pound	1 Egyptian Pound = 11.1 PKR
Jordan	Jordanian Dinar	1 Jordanian Dinar= 247.0 PKR
Indonesia	Indonesian Rupiah	1 PKR= 82.3 Indonesian Rupiah
Niger	West African CFA franc	1 PKR = 3.28 West African CFA franc
Iraq	Iraqi Dinar	1 PKR = 8.3 Iraqi Dinar

e. Important Locations

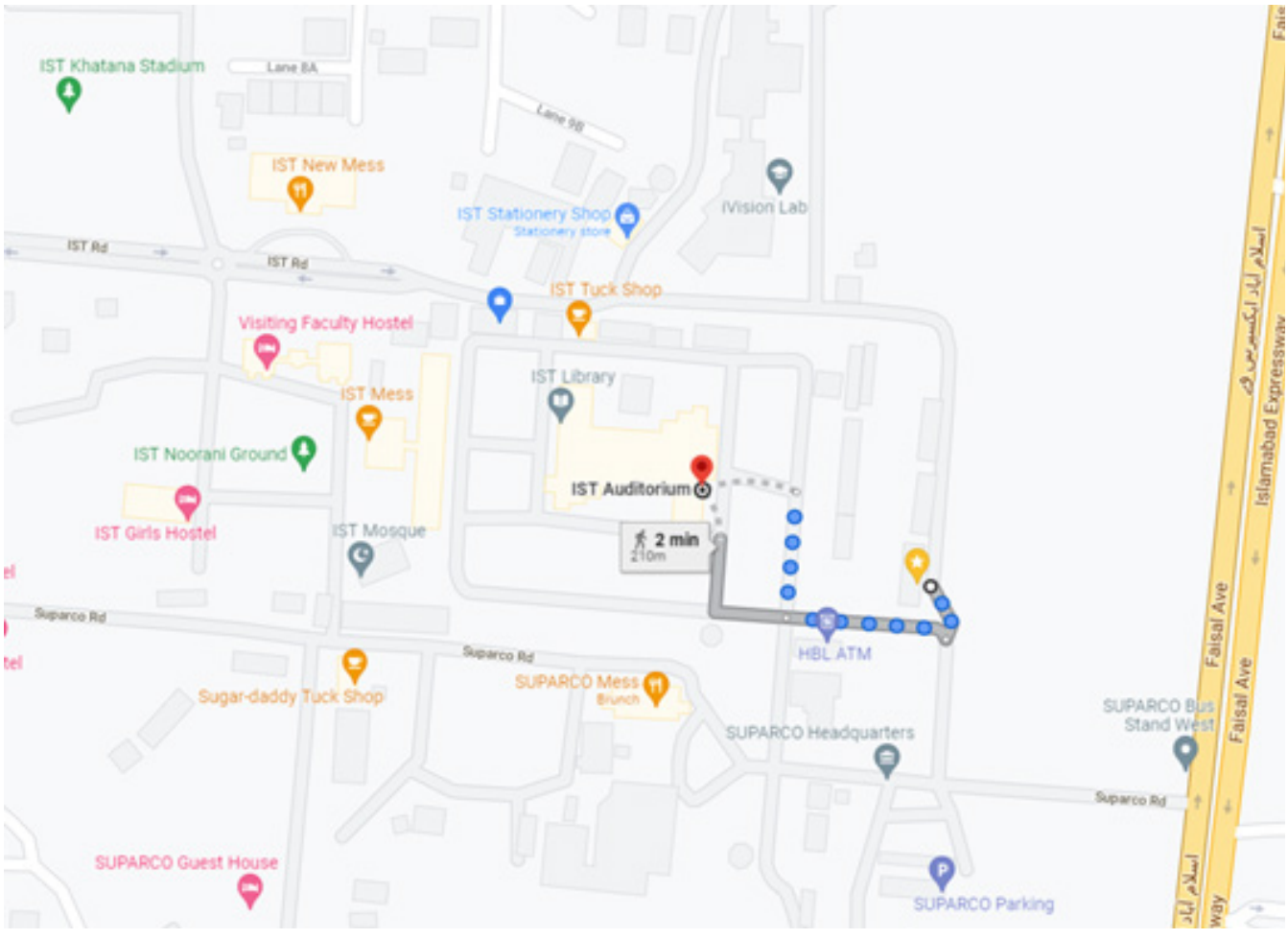
1. IST - Jacaranda Family Club



2. Islamabad Highway - IST Parking



3. IST Main Gate - IST Raza Block



f. Wifi Information

ICASE 2021 Participants, guests and visitors can login to the WiFi by following the steps below:

- Connect with SSID “eduroam”
- Select “Do not validate” in CA Certificate
- Enter your Fully Qualified Domain Name (FQDN) User
- ID: icase21@ist.edu.pk
- Password: icase21
- Obtain IP address automatically.
- No Proxy is required in the Browser.

g. Venue Map


Map of Institute of Space Technology
N
W
E
S
STAFF HOSTEL
BOYS HOSTEL
BLOCK 7
Sports Ground
Lawn
Mess
FACULTY SUITES
BLOCK 3
Tuck Shop
BLOCK 4
Gate 2
Lawn
BLOCK 2
Back Lawn
RAZA BLOCK
BLOCK 1
Front Lawn
BLOCK 5
Parking
GIRLS HOSTEL
Mosque
Side Lawn
Lawn
Gate 1
ATM
Express Highway
Meters
0 25 50 100 150 200

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