

Muhammad Mubasshir Shaikh



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Education & Qualifications

PhD in Electronics & Telecommunications Engineering *Politecnico di Torino, Italy.* [2012-2015]
Thesis Title: GNSS Radio Occultation (RO) for Ionospheric Monitoring – Impact and Mitigation of High Solar Activity Effects

MSc in Satellite Navigation (GNSS) & Related Applications *Politecnico di Torino, Italy.* [Sep 2010 – Sep 2011]
Major Courses: Atmospheric & Environmental Applications of GNSS Technology, GNSS Remote Sensing, Radar and Remote Sensing, Basics on Geomatics and Satellite Orbits, GPS & Galileo Receivers, Satellite based Augmentation Systems

MSc in Radio & Mobile Communication Systems *University of Hertfordshire, UK.* [Sep 2005 – Sep 2006]
Major Courses: Radio & Mobile Communication Systems, Digital Signal Processing, Mixed-VLSI

BSc in Electronics *University of Karachi, Pakistan.* [Jan 2000 – Dec 2003]
Major Courses: Electronics Design, Radio Communication Systems, Digital Signal Processing, Programming Languages (Assembly for microcontrollers, Fortran & Matlab), Introduction to Quantum and Solid-State Technology.

Employment History

Principal Investigator - Space Weather & Ionosphere (SW&I) Laboratory [Oct 2016 – Present]
Sharjah Academy for Astronomy, Space Sciences and Technology (SAASST), Sharjah, UAE.

At the time of joining as visiting assistant professor, I partially worked at SAASST as principal investigator and founded a state-of-the-art space weather laboratory to monitor the impact of space weather on the upper atmosphere. The lab is equipped with a multi-constellation, multi-frequency GNSS receiver capable of monitoring ionospheric scintillation and a digital ionosonde radar for ionospheric monitoring.

Lab Instructor - Department of Electrical Engineering [Sep 2022 – Present]
University of Sharjah, Sharjah, UAE.

Currently working part-time as lab instructor teaching following lab courses:

- Fundamental of Electronics Circuits Lab
- Applied Electronics for SREE Lab

Visiting Assistant Professor - Department of Applied Physics & Astronomy [Oct 2016 – Aug 2019]
University of Sharjah, Sharjah, UAE.

Actively participated in the accreditation of MSc in Astronomy and Space sciences and developed curriculum for different courses. Served in department committees on research and conference management. Taught following courses:

- Electronics for Experimental Physics 1
- Astronomy and Space Sciences
- Remedial Physics
- Solar and Space Physics

Visiting Research Scientist – Applied Physics (Telecommunications) Laboratory [Feb 2015 – Sep 2016]
Abdus Salam International Center for Theoretical Physics (ICTP), Trieste, Italy

Worked with Global Navigation Satellite System Data for modelling of space weather perturbations on the signal and systems. My other research activities included modelling of GPS total electron content and study of low-latitude ionospheric scintillation using radio occultation technique.

Research Fellow - Marie Curie Early Stage Researcher [Sep 2011 – Jan 2015]
Department of Electronics & Telecommunications, Politecnico di Torino, Torino, Italy

TRANSMIT project was a prestigious Marie Curie Initial Training Network (ITN), funded by the European Commission including partners such as Spirent, Septentrio, Thales Italy, ICTP, ISC-CNR, Fugro etc. My part of the project was focused on the development of the model-aided inversion algorithm for GNSS radio occultation observations of the ionosphere. The idea was to find a way to mitigate the effect of the spherical symmetry hypothesis from ionospheric RO data inversion using models.

Assistant Manager – Satellite Ground Segment Section

[Jun 2007 – Dec 2011]

Space & Upper Atmosphere Research Commission, Karachi, Pakistan.

I worked as part of a team for the planning, designing and development of data communication network for LEO/GEO satellite ground stations (Period from Sep 2010 to December 2011 was spent in Italy for specializing Master study).

Test Engineer - Electronics

[Jan 2004 – Aug 2004]

SYSTEK Private Limited, Karachi, Pakistan

I worked as test engineer for the manufacturing of inverters and uninterruptible power supplies.

Research Interests & Skills

- Embedded Systems
- GNSS Applications for Upper Atmosphere
- Space Weather
- Research Management
- Global Navigation Satellite Systems
- Data Assimilation Techniques
- Scientific Programming
- Resource Planning
- Radio Occultation Technique
- Empirical modelling
- Scientific Proposal Writing
- Research Paper Writing

Teaching Interests

- Electronic Circuits
- Communications Electronics
- Satellite Navigation
- Signals and Systems
- Wireless Communication
- Computer Comm. and Networks
- Telecommunication Systems
- Cellular Communication
- Space Technology

Teaching and Training Skills

- Course/Curriculum Development
- Course Coordination
- Effective Communication
- Seminar and Conference Coordination
- Course Accreditation
- Time Management
- Effective Use of IT resources
- Resource Planning
- Lesson Planning
- Classroom Management
- Assessment and Feedback
- Compassion and Empathy

Projects In-progress

One national level and two other collaborative projects are currently in progress at SAASST under my supervision:

• Unified GNSS Network (UGN)

UGN network is a national level project proposal to develop a data hub for GNSS data in the UAE. The idea has been in discussion with UAE Space Agency for two years and several meetings have been conducted between University of Sharjah and the UAE Space Agency. The proposal is currently being reviewed by the UAE federal government.

• Global Navigation Satellite System (GNSS) Simulator

At Space Weather & Ionosphere lab, a GNSS simulator is currently being designed and developed. The purpose of this simulator is to simulate GNSS signal in a control environment for the design and development of future, low cost GNSS satellite payloads.

Completed Projects and Grants

Since 2016, as principal investigator (PI) and co-PI, I am currently working on the following research projects/grants:

• Ionospheric Research Proposal

Granted approximately AED 1 million by the University of Sharjah for the development of Space Weather & Ionosphere lab.

• Radio Astronomy Decametric Telescope

Granted with AED 440,000 by UAE Space Agency for the development of Decametric telescope.

• Comparative Planetology of Martian Ionosphere

Granted with AED 80,000 by University of Sharjah for the research related to the Martian ionosphere.

• Validation of Earth's Topside Ionosphere for Ionospheric Modelling

Granted with AED 31,000 by University of Sharjah for ionospheric research using GNSS technology.

Previously Completed On-the-Job Projects

Relocation of Badr-B Satellite Ground Station

[2010]

Actively participated in the relocation of Pakistan's oldest ground station that was used to track first remote sensing satellite Badr-B. The project brought huge challenges because of its old design and interfaces. Project involved complete systems engineering of the ground communication system.

Integration, Testing and Commissioning of Weather Satellite Ground Station [2009]
A multi-million rupees Weather Satellite Reception, Processing & Archiving station was installed with the help of a well reputed Australian research organization ES&S. As assistant manager, I assisted the project manager in all technical areas of project execution.

Design & Development of Low Resolution Weather Satellite Ground Station [2009]
The project was to develop a low-cost ground station for the weather satellite imaging. We worked on an algorithm to improve the image quality after receiving raw data from low resolution experimental weather satellites.

Completed Training

Technical Training

China Satellite Launch and Tracking Control (CLTC), Beijing, China [Nov 2009 - Jan 2010]
Completed three months' training in China for the design and development of satellite telemetry, tracking and commanding (TT&C) station.

LEO Imaging Satellite Ground Station, Islamabad, Pakistan [Mar 2009]
Completed 15 days training on operations of satellite's Image Data Reception, Processing & Archiving Station for SPOT-5.

LEO Satellite Telemetry, Tracking and Commanding Ground Station, Lahore, Pakistan [May 2008]
Completed a week's training on operations of Badr-B satellite's TT&C station, Lahore, Pakistan.

Management Training

Design of Industrial Systems through the 'Systems Engineering', Torino, Italy [May 2014]
The training was aimed at theoretical and practical aspects of the 'Systems Engineering' considering case studies from mechanical engineering (railways, industrial and micro systems) and aerospace engineering (aircraft and spacecraft).

Training on Project Management Professional Certification, Karachi, Pakistan [May - Aug 2009]
Four months' training for the preparation of Project Management Professional (PMP) certification. The course provided training on essential Project Management Body of Knowledge (PMBOK) guide terminology, tools and techniques.

Memberships

- Institute of Navigation
- International Astronomical Union

Research Collaborations

- Telecommunications Laboratory, ICTP, Italy
- UAE Space Agency, UAE
- University of New Brunswick, Canada
- Frederick University, Cyprus

Academic Honors and Awards

- Marie Curie Fellowship funded by the European Commission, as an Early-Stage Researcher.
- UN Long Term Fellowship' on GNSS & Related Applications'.

Certifications

- Satellite Toolkit (Analytical Graphics Inc.) Certification
- CubeSat design and development (Istanbul Technical University)

List of Publications

Submitted Articles

Shaikh M.M., Halawa S.S., and Fernini I. (2023). Investigation on the Semidiurnal Descent of Sporadic-E Layer using Ionosonde Height-Time-Intensity Data. Under review at the Journal of Geophysical Research.

Darya A. M., **Shaikh M.M.**, and Fernini I. (2023). Localization of ionospheric irregularities over Arabian Peninsula using GNSS based scintillation indices. Under review at the Journal of the Institute of Navigation.

Abusirdaneh M.A.K., **Shaikh M.M.**, and Fernini I. (2023). Modelling the incoherent scatter radar vertical electron density profiles using smoothing splines. Under review at the journal Advances in Space Research.

Published Journal Articles

Shaikh M.M. (2022). *Single Station Bias Calculation using Data from Calibrated GNSS Station for Various Baseline Distances*. Progress in Earth and Planetary Sciences. <https://doi.org/10.1186/s40645-022-00533-z>.

Shaikh M.M. (2022). *NeQuick2 Validation using Multi-satellite and Ground Data*. Advances in Space Research. <https://doi.org/10.1016/j.asr.2022.11.004>.

Darya A.M., **Shaikh M.M.**, Fernini I. and Al-Naimy H. (2022). *Mapping of S4 Over the Arabian Peninsula During Solar Minimum*. IEEE Geoscience and Remote Sensing Letters.

Shaikh M.M. (2022). *On the Use of Empirical Models for High-latitude Ionosphere*. Journal of Atmospheric and Solar Terrestrial Physics. <https://doi.org/10.1016/j.jastp.2022.105935>.

Shaikh M.M. (2021). *Retrieval of Ne(h) Profile for Ionosonde by Assimilating Collocated Radio Occultation Data into NeQuick2*. GPS Solutions. <https://doi.org/10.1007/s10291-021-01180-5>.

Shaikh M.M., Gopakumar G., Fernini I., Aisha Alowais and Maryam Sharif (2021). *Contribution of Meteor Flux in the Occurrence of Sporadic-E over Arabian Peninsula*. Annales Geophysicae. <https://doi.org/10.5194/angeo-39-471-2021>.

Shaikh M.M., Gopakumar G., AbdelRahman H. K., Kashcheyev A. and Fernini I. (2020). *Daytime GNSS scintillation due to Es over Arabian Peninsula in Low Solar Activity*. Results in Physics. <https://doi.org/10.1016/j.rinp.2020.103761>.

Shaikh M.M. (2020). *Performance Evaluation of Model-assisted Data Inversion Technique for Ionospheric Radio Occultation*. Advance in Space Research. <https://doi.org/10.1016/j.asr.2020.06.042>.

Shaikh M.M., Fernini I., Gopakumar G. and Alameri N. (2020). *Occurrence of Pre-sunset L-band Scintillation Due to Strong Presence of Sporadic-E over Arabian Peninsula*. Advantage Space Research. <https://doi.org/10.1016/j.asr.2020.02.011>.

Darya A. M., **Shaikh M.M.**, Fernini I. (2019). *Variation of Ionospheric Range Errors for L1 frequency GPS users during 23rd solar cycle*. Advances in Space Research. <https://doi.org/10.1016/j.asr.2019.05.044>.

Shaikh M.M., Nava B., and Haralambous H. (2018). *On the use of topside RO derived electron density for model validation*. Journal of Geophysical Research – Space Physics. <https://doi.org/10.1029/2017JA025132>.

Shaikh M.M., Nava B., and Kashcheyev A. (2017). *A Model-assisted Radio Occultation (RO) Data Inversion Method based on Data Ingestion into NeQuick*. Advances in Space Research. <https://doi.org/10.1016/j.asr.2016.09.006>.

Shaikh M.M., Notarpietro R., and Nava B (2014). *The Impact of Spherical Symmetry Assumption on Radio Occultation Data Inversion in the Ionosphere: An Assessment Study*. Advances in Space Research. <https://doi.org/10.1016/j.asr.2013.10.025>.

Book Chapters

Shaikh M.M., Notarpietro R., Nava B. (2014) *Implementation of Ionospheric Asymmetry Index in TRANSMIT Prototype, Mitigation of Ionospheric Threats to GNSS: An Appraisal of the scientific and technological outputs of the TRANSMIT project*, ISBN: 978-953-51-4143-3.

Shaikh M. M. (2018). *Our Sun – Beyond Everyday Life*. Astronomical Handbook 2018, Sharjah Center for Astronomy and Space Sciences, University of Sharjah.

Shaikh M. M. (2019). *Radio Occultation Technique – A way to know our Celestial Neighborhood*. Astronomical Handbook 2019, Sharjah Academy for Astronomy, Space Sciences and Technology, University of Sharjah.

Shaikh M. M. (2020). *Martian Atmospheric/Ionospheric Exploration Missions*. Astronomical Handbook 2020, Sharjah Academy for Astronomy, Space Sciences and Technology, University of Sharjah.

Shaikh M. M. (2021). *Space Weather Data Calibration and Prediction using Artificial Intelligence*. Astronomical Handbook 2021, Sharjah Academy for Astronomy, Space Sciences and Technology, University of Sharjah.

Shaikh M. M. (2020). *Space Mining – Science Fiction to Reality*. Astronomical Handbook 2022, Sharjah Academy for Astronomy, Space Sciences and Technology, University of Sharjah.

Conference Proceedings and Talks (last 5 years only)

Shaikh M.M., Darya A.M., Abusirdaneh M.A., and Fernini I. (2023). *Anomalous High Amplitude Scintillation Observed from GLONASS Satellites during Low Solar Activity*. International Astronautical Congress 2023, Baku, Azerbaijan.

Shaikh M.M., Suhail S., Abusirdaneh M.A., Darya A.M., and Fernini I. (2023). *Investigation on the Semidiurnal Descent of Sporadic-E Layer using Ionosonde Height-Time-Intensity Data*. International Astronautical Congress 2023, Baku, Azerbaijan.

Suhail S., **Shaikh M.M.**, and Fernini I. (2023). *Developing a Toolkit for Efficient Analysis of Cadi Ionosonde Data*. International Astronautical Congress 2023, Baku, Azerbaijan.

Shaikh M.M., and Fernini I. (2022). *A Comparative Analysis of Global vs Regional Model at High-latitudes*. ION GNSS+ 2022, the Institute of Navigation, Denver Colorado, USA.

Shaikh M.M., Darya A.M., Suhail S., Abusirdaneh M.A., and Fernini I. (2022). *Diurnal and Seasonal Variations of GNSS based Ionospheric Slab Thickness over Arabian Peninsula*. International Astronautical Congress 2022, Paris, France.

Shaikh M.M., and Fernini I. (2022). *Calculating Station Bias for Uncalibrated GNSS Stations Using Close-Range Calibrated GNSS Station Data*. International Astronautical Congress 2022, Paris, France.

Darya A.M., Suhail S., **Shaikh M.M.**, Fernini I. (2022). *Global Ionospheric Total Electron Content Response to the November 2021 Geomagnetic Storm*. Mediterranean Geosciences Union (MedGU) Meeting, Marrakech.

Darya A.M., **Shaikh M.M.**, and Fernini I. (2022). *Artificial Phase Scintillation Observed from GLONASS Signals*. International Workshop on GNSS Ionosphere, Neustrelitz, Germany.

Abusirdaneh M.A., **Shaikh M.M.**, Darya A.M., and Fernini I. (2022). *Reconstruction of Incoherent Scatter Radar Vertical Electron Density Profiles using Regression Trees*. International Astronautical Congress 2022, Paris, France.

Suhail S., **Shaikh M.M.**, and Fernini I. (2022). *A GPS Simulator for the Design and Development of a Future Low-cost GNSS*. International Astronautical Congress 2022, Paris, France.

Darya A.M., Alnajjar K., **Shaikh M.M.**, Abdallah S., and Fernini I. (2022). *GPS Carrier-to-Noise Density Prediction using Regression Trees*. International Astronautical Congress 2022, Paris, France.

Darya A.M., Al-Owais A., **Shaikh M.M.**, Fernini I. (2022). *Amplitude Scintillation Forecasting using Bagged Trees*. IEEE IGARSS 2022, Kuala Lumpur, Malaysia.

Darya A.M., Alameri A., **Shaikh M.M.**, Fernini I. (2022). *Martian Ionosphere Electron Density Prediction Using Bagged Trees*. The International Conference on Electrical and Computing Technologies and Applications (ICECTA), Ras Al Khaimah, UAE.

Darya A.M., **Shaikh M.M.**, Fernini I., Al-Naimiy H. (2022). *Abnormal Phase Scintillation Observed from GLONASS Signals*. The International Conference on Electrical and Computing Technologies and Applications (ICECTA), Ras Al Khaimah, UAE.

Shaikh M.M., and Fernini I. (2021). *Retrieval of Ne(h) Profile for Ionosonde by Assimilating Collocated Radio Occultation Data into NeQuick2*. Proceedings of ION GNSS+, the Institute of Navigation, Saint Louis, USA (virtual).

Shaikh M.M., and Fernini I. (2021). *Pre-sunset L-band Scintillation over Arabian Peninsula*, Proceedings of Remote Sensing, Atmospheric Effects, and Space Weather, International Technical Meeting (ITM), Institute of Navigation, USA (virtual).

Kalemci E., Manousakis A., Fernini I. et al. (2021). *Scientific Contribution of Sharjah-Sat-1 to X-ray Observations*. 72nd International Astronautical Congress, Dubai, UAE.

Sowdagar S., Musharraf M., **Shaikh M.M.** et al. (2021). *Regional Ionospheric Range Errors – A Comparison Between Sharjah and Bahrain Regions*. 72nd International Astronautical Congress, Dubai, UAE.

Shaikh M.M. (2020). *Performance Evaluation of a Model-assisted Radio Occultation Data Inversion Technique*. 33rd General Assembly and Scientific Symposium, International Union of Radio Science, Rome (virtual).

Shaikh M.M., Gopakumar G. and Darya A. M. (2019). *Comparative Study of Amplitude Scintillation (S4 Index) on Different GNSS L-band Frequencies in Association of Sporadic-E over Northern Crest of Magnetic Dip Equator near Arabian Peninsula*. ION GNSS+, Miami, USA.

Darya A. M., **Shaikh M.M.**, and Fernini I. (2019). *Longitudinal Variability Study of Ionospheric Ranging Errors Around 20° N Geomagnetic Latitude*. 6th IEEE Int. Conf. on Space Science and Communication (ICONSPACE), Johor Bahru, Malaysia.

Faroukh Y.M., **Shaikh M.M.**, Al-Ali A.A., Faroukh A.M. et al. (2019). *Environmental Monitoring using CanSat*. 6th IEEE Int. Conf. on Space Science and Communication (ICONSPACE), Johor Bahru, Malaysia.

Alameri N.A., **Shaikh M.M.**, and Fernini I. (2019). *Comparative Planetology of Martian Ionosphere*. 70th International Astronautical Congress, Washington D.C., USA.

Aslan A.R., AlNaimiy H.M.K., Fernini I., Manousakis A., **Shaikh M.M.** et al. (2019). *Space Technology Capacity Building in Support of SDG 2030 Through CubeSat SharjahSat-1*. 9th Int. Conference on Recent Advances in Space Technologies (RAST), Istanbul.

Madara S.M., AlKaabi T., Fernini I., Manousakis A., **Shaikh M.M.**, et al. (2019). *Development of Sharjah-Sat-1: An improved Z-ray detector onboard a 3U cbesat*, 11th European Cubesat Symposium, Luxembourg.

Shaikh M.M., Nava B. and Haralambous H. (2018). *On the use of topside RO derived electron density for model validation*, Proceedings of 15th European Space Weather Week, Brussels, Belgium.

Darya A. M., **Shaikh M.M.**, and Fernini I. (2018). *Effects of 23rd Solar Cycle on TEC Measurement over Bahrain – A Case Study*. Aviation and Space Technology International Conference (IEEE ASET '18), Dubai, UAE.

Alsadoon W. F., **Shaikh M.M.**, and Fernini I. (2018). *Evaluation of Geomagnetic Storms – A Case Study*. Aviation and Space Technology International Conference (IEEE ASET '18), Dubai, UAE.