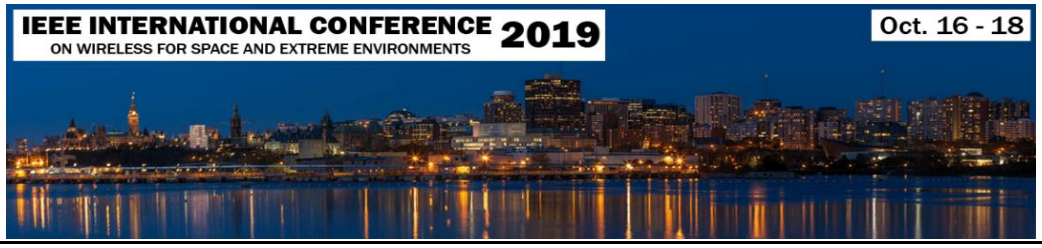


Integrated Ground-Air-Space Borne Communications (IGASC)

Workshop

WORKSHOP CO-CHAIRS:

Salman Durrani (Australian National University, Australia)
Bulent Tavli (TOBB University, Turkey)
Sergey Andreev (Tampere University, Finland)
Irem Bor-Yaliniz (Carleton University, Canada)

SCOPE AND MOTIVATION:

There have been significant advancements on satellite and aerial vehicle technologies, which reinforced their applications, and wireless service provisioning is no exception. In the 5G era and beyond, integration of terrestrial networks with the new air- and space-borne segments emerged as a convoluted and multi-faceted challenge. While space-borne networks include GEO, MEO, and LEO satellites, air-borne systems incorporate HAPs, LAPs, as well as smaller unmanned aerial vehicles (UAVs or drones). The versatility of flying equipment and changes in altitudes enable various trade-offs, challenges, and phenomena requiring investigation.

The Workshop on Integrated Ground-Air-Space Borne Communications solicits original and high-quality work on exploring and quantifying new technical breakthroughs, applications, methods, and experiments focused on all the aspects of aerial and satellite communications, as well as their interaction with the conventional terrestrial networks.

MAIN TOPICS OF INTEREST:

Workshop on Integrated Ground-Air-Space Borne Communications (IGASC) solicits original contributions in, but not limited to, the following topical areas:

- Hybrid space-ground, air-ground, and space-air-ground networks
- Integration of satellites and UAVs into 5G systems and beyond
- New opportunities/challenges/use cases for integrating UAVs and satellites into 5G+
- Novel architectures and communication protocols with aerial users/platforms in hybrid deployments
- Channel measurements and modeling for UAV-to-ground, UAV-to-UAV, and cross-link communications
- Near-Earth satellite communications

- Antenna design for satellite and UAV Communications
- MIMO/massive MIMO/mmWave technologies for satellite and UAV communications
- Coding, modulation, and synchronization schemes for satellite and UAV usage
- Satellite and space communications and networking
- Channel models for space-borne and air-borne communications
- Security, privacy, and trust in integrated air- and space-borne communications
- Radio resource management in satellite, UAV, and integrated networks
- Cognitive satellite and UAV systems
- Delay Tolerant Networking for satellite applications
- QoS and QoE in integrated ground-air-space borne deployments
- Interference mitigation techniques over satellite and UAV channels
- Utilization of nano-satellites
- Design of mega-constellations
- M2M/MTC over non-terrestrial layouts
- Emerging standards: DVB-Sx, DVB-SH, DVB-RCS2, and IP over satellite
- Signal detection and estimation for satellite and aerial communications
- Statistical and adaptive signal processing for non-terrestrial systems
- Disaster recovery based on air- and space-borne communications
- Ultra-reliable and low-latency communications (URLLC) for air-borne, space-borne, and integrated systems
- Internet of Remote Things
- Safety issues in UAV and satellite services
- Multiple access schemes for connected UAVs
- Cellular systems with coexisting aerial and terrestrial users
- 3D aerial deployments and relay placement strategies
- UAV/satellite trajectory optimization
- Spectrum sharing and management in integrated networks
- UAV energy consumption modeling
- Energy-efficient non-terrestrial communications
- UAV and satellite systems with caching/edge computing/wireless power transfer
- Drone-aided positioning

KEYNOTE:

Prof. Halim Yanikomeroglu
Systems and Computer Engineering Department
Carleton University, Ottawa, ON, Canada

A Disruptive Wireless Access Architecture for 6G Networks of 2030s

The 5G standards are currently being developed with a scheduled completion date of December 2019; the 5G wireless networks are expected to be deployed globally throughout 2020s. As such, it is time to reinitiate a brainstorming endeavour followed by the technical groundwork towards the subsequent generation (6G) wireless networks of 2030s.

5G promises to provide connectivity for a broad range of use-cases in a variety of vertical industries; after all, this rich set of scenarios is indeed what distinguishes 5G from the previous four generations. Many of the envisioned 5G use-cases require challenging target values for one or more of the key QoS elements, such as high rate, high reliability, low latency, and high energy efficiency; we refer to the presence of such demanding links as the super-connectivity.

However, the very fundamental principles of digital and wireless communications reveal that the provision of ubiquitous super-connectivity in the global scale – i.e., beyond indoors, dense downtown or campus-type areas – is infeasible with the legacy terrestrial network architecture as this would require prohibitively expensive gross over-provisioning. The problem will only exacerbate with the even more demanding 6G use-cases such as autonomous aerial vehicles requiring connectivity, thus the 3D super-connectivity.

In this presentation, we will explore a 5-layer vertical architecture composed of fully integrated terrestrial and non-terrestrial layers for networks of 2030s:

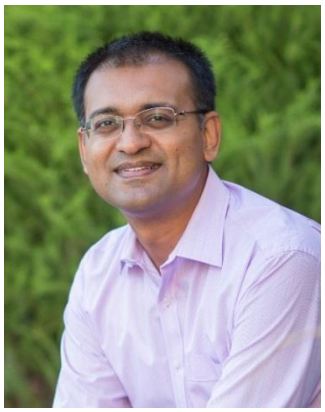
- Terrestrial HetNets with macro-, micro-, and pico-BSs
- Flying-BSs (aerial-/UAV-/drone-BSs); altitude: up to several 100 m
- High Altitude Platforms (HAPs) (floating-BSs); altitude: 20 km
- Very Low Earth Orbit (VLEO) satellites; altitude: 300-1,200 km
- Geostationary Orbit (GEO) satellites; altitude: 35,786 km

In the absence of a clear technology roadmap for the 2030s, the presentation has, to a certain extent, an exploratory view point to stimulate further thinking and creativity on opportunities and challenges. We are certainly at the dawn of a new era in wireless research and innovation; the next twenty years will be very interesting.

Biography:

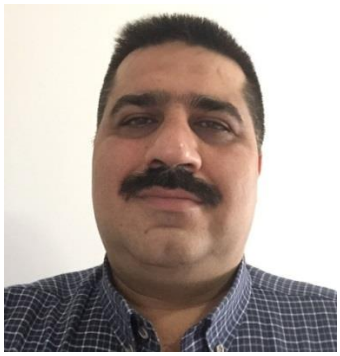
Halim Yanikomeroglu is a Professor in the Department of Systems and Computer Engineering at Carleton University, Ottawa, Canada. His group made contributions to 4G and 5G wireless networks. He has had extensive collaboration with industry which resulted in 29 granted patents. During 2012-2016, he led one of the largest academic-industrial collaborative research projects on pre-standards 5G wireless, sponsored by the Ontario Government and the industry. In Summer 2019, he started a new project on the 6G access architecture. Dr. Yanikomeroglu supervised 22 PhD students (all completed with theses). He coauthored 380+ peer-reviewed research papers including 130+ published in the IEEE journals; these publications have received 12,000+ citations. He is a Fellow of IEEE, a Fellow of Engineering Institute of Canada (EIC), a Fellow of Canadian Academy of Engineering (CAE), and a Distinguished Speaker for both IEEE Communications Society and IEEE Vehicular Technology Society. He has been one of the most frequent tutorial presenters in the leading international IEEE conferences (32 times). He served as the General Chair and Technical Program Chair of several major international IEEE conferences. He is currently serving as the Chair of the Steering Committee of IEEE's flagship Wireless Communications and Networking Conference (WCNC).

SHORT BIOGRAPHIES OF CO-CHAIRS:

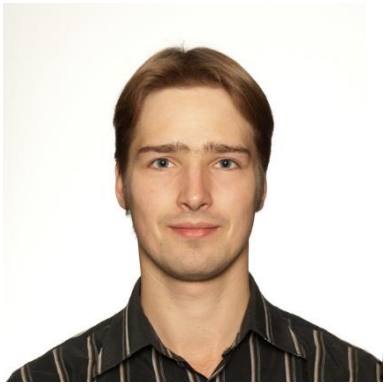


Salman Durrani received the B.Sc. (1st class honours) degree in Electrical Engineering from the University of Engineering & Technology, Lahore, Pakistan in 2000. He received the PhD degree in Electrical Engineering from the University of Queensland, Brisbane, Australia in Dec. 2004. He has been with the Australian National University, Canberra, Australia, since 2005, where he is currently Associate Professor in the Research School of Engineering, College of Engineering & Computer Science. His research interests include wireless information and power transfer, energy-harvesting-enabled wireless communications, drone communications, machine-to-machine and device-to-device communication, stochastic geometry modelling of finite area networks and synchronization in communication systems.

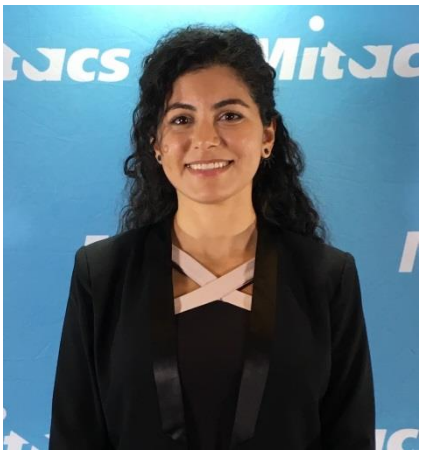
Dr. Durrani has co-authored more than 140 publications to date in refereed international journals and conferences. He was a recipient of the 2016 IEEE ComSoc Asia Pacific Outstanding Paper Award. He was the Chair of the ACT Chapter of the IEEE Signal Processing and Communications Societies from 2015 to 2016. He currently serves as an Editor of the IEEE TRANSACTIONS ON COMMUNICATIONS. He was awarded the 2018 ANU VC Award for Excellence in Supervision and the 2012 ANU VC Award for Excellence in Education. He is a Member of Engineers Australia, a Senior Fellow of IEEE, USA and a Senior Fellow of The Higher Education Academy, UK.



Bulent Tavli is professor of electrical and electronics engineering at TOBB University of Economics and Technology, Ankara, Turkey. He received the PhD degree in electrical and computer engineering at University of Rochester, NY, USA in 2005. His main research interests are non-terrestrial communications, Internet-of-Things, wireless sensor networks, smart grid, privacy and security, embedded systems, mathematical programming, and machine learning. He is an associate editor of IEEE communications surveys & tutorials. He is an IEEE senior member.



Sergey Andreev is an assistant professor of communications engineering and Academy Research Fellow at Tampere University, Finland. Since 2018, he has also been a Visiting Senior Research Fellow with the Centre for Telecommunications Research, King's College London, UK. He received his Ph.D. (2012) from TUT as well as his Specialist (2006) and Cand.Sc. (2009) degrees from SUAI. He serves as editor for *IEEE Wireless Communications Letters* (2016-) and as series editor of the IoT Series (2018-) for *IEEE Communications Magazine*. He (co-)authored more than 200 published research works on intelligent IoT, mobile communications, and heterogeneous networking.



Irem Bor-Yaliniz received her B.Sc. and M.Sc. degrees in electrical and electronics engineering from Bilkent University, Turkey, in 2009 and 2012, respectively. She is currently a Ph.D. candidate at Carleton University, Canada. She has also been with Huawei Ottawa Research & Development Centre since 2017. She is the co-inventor of 15+ patent applications worldwide, and received scholarships through the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Queen Elizabeth II Scholarship in Science and Technology. She has been a reviewer for leading IEEE journals and conferences. She is a senior member of IEEE, and listed as one of the 10 Rising Stars in Computer Networking and Communications by N2Women in 2019.