

Reconfigurable Intelligent Surfaces (RIS) for Integrated Communication, Sensing, and Localisation

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Reconfigurable Intelligent Surfaces (RIS) have emerged as a transformative technology for next-generation wireless networks, enabling precise control of electromagnetic waves to enhance communication, sensing, and localisation. RIS leverages programmable metasurfaces composed of sub-wavelength reflective elements to dynamically manipulate the amplitude, phase, and polarization of incident waves. This capability supports diverse applications in 6G scenarios, including high-speed data transmission, real-time health monitoring, and indoor localisation. In communication, RIS improves energy efficiency and signal coverage, particularly in Non-Line-of-Sight (NLoS) environments. It achieves efficient beamforming with minimal power consumption and low hardware complexity. For sensing applications, RIS enables high-accuracy vital sign detection, including real-time heartbeat and respiration monitoring in NLoS conditions, overcoming limitations of conventional RF sensing technologies. For localisation, RIS enhances the performance of machine-learning-based indoor positioning systems by reshaping radio wave propagation and reducing multipath fading effects. The technology supports both active and passive localisation methods, making it ideal for complex, dynamic environments. RIS holds immense potential in integrated sensing and communication (ISAC) systems, paving the way for innovative solutions in smart homes, healthcare, and urban environments. By addressing challenges such as NLoS coverage, hardware constraints, and energy efficiency, RIS is poised to play a critical role in realising the vision of ubiquitous, intelligent, and sustainable wireless networks.

Qammer H. Abbasi (SMIEEE, FRET, FRSA, FEAI, FIET), Professor of Applied Electromagnetics & Sensing with the James Watt School (JWS) of Engineering, Theme lead for Connecting People priority at JWS, Director for Communication Sensing and Imaging (CSI) Hub, UK Government's Policy Advisor in Department for Science Innovation & Technology and The Scottish Science Advisory Council Member. He has grant portfolio of £13M+ and contributed to more than 500+ leading international technical journal (including nature portfolio) and peer reviewed conference papers, 11 books and received several recognitions for his research including UK exceptional talent endorsement by Royal Academy of Engineering, Sensor 2021 Young Scientist Award, University level Teaching excellence award in addition to coverage by various media houses globally, BBC news, Scotland TV, Fiercewireless, theEngineers and many other media houses. Prof. Abbasi is an IEEE senior member and is chair of IEEE APS/MTT UK, Ireland and Scotland joint chapter. He is an Associate editor for IEEE Sensors, IEEE open journal of Antenna and Propagation, IEEE JBHI and scientific reports. He is IEEE APS distinguished lecturer (2024-26), Vice-Chair of IEEE APS Young professional committee, Sub-committee chair for IEEE YP Ambassador program, committee member for IEEE 1906.1.1 standard on nano communication, IEEE APS/SC WG P145, IET Antenna & Propagation and healthcare network. He is/was Fellow of Royal Society of Arts, industrial Fellow of Royal Academy of Engineering (2022-23), Fellow of Institution of Engineering & Technology, Fellow of European Alliance of innovation, and Fellow of the Royal Society of Edinburgh.

<https://r8.ieee.org/italy-apedmtt/>



Schedule

- **When:** Wednesday May 7, 2025, h. 11:00
- **Where:** **onsite** at Sala Polifunzionale BUM, Via Mesiano 77, Trento, and **online** at <https://unitn.zoom.us/j/85955021363?pwd=2SigXbH78loTIHrF9A1ox5v7hgg6tc.1>

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