

Chapter Seminar

Revisiting Fractals and Fractional Dimensions in Electromagnetics: Unlocking New Approaches in Design and Analysis of Practical Devices

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Time: 12:00 (Italy time)

Location: **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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Fractals and fractional dimensions offer novel perspectives in the analysis and design of electromagnetic devices. This talk revisits the concepts of fractal and fractional spaces, introducing them as transformative approaches for modeling and optimizing complex systems. We will discuss how these methods enhance EM field manipulation in anisotropic, disordered, and fractal media, and review recent applications, such as field emission, rough surface modeling, charge transport, and advanced wave manipulation. Through practical examples, this talk aims to showcase how fractal and fractional techniques can address emerging challenges in EM design and invite the wider engineering community to explore these methodologies in their work.

Dr. Muhammad Zubair (Senior Member, IEEE) received the Ph.D. degree in electronics and communication engineering from the Politecnico di Torino, Italy, in 2015. From 2015 to 2017, he was a Postdoctoral Research Fellow at the SUTD-MIT International Design Centre, Singapore. In 2017, he joined the Information Technology University, Lahore, where he served as an Assistant Professor and was later promoted to Associate Professor in 2021. He has held visiting research positions at King Abdullah University of Science and Technology (KAUST) and the Singapore University of Technology and Design (SUTD). Since 2024, he has been affiliated with the James Watt School of Engineering, University of Glasgow, UK. His research interests include metamaterials and metasurfaces, fractional modeling, applied electromagnetics, and nanophotonics, with a focus on developing models, materials, and devices for advanced electronic and photonic technologies. He has contributed as a PI/Co-PI or researcher co-lead in projects funded by the Qatar National Research Foundation, the Higher Education Commission of Pakistan, the Punjab Higher Education Commission, the Ministry of Education (Singapore), Singapore Temasek Lab, EPSRC (UK), the US Army Research Laboratory (ARL), and the US Air Force Office of Scientific Research (AFOSR). Dr. Zubair has authored over 200 peer-reviewed journal and conference publications and co-authored two book chapters. Since 2022, he has been recognized among the top 2% of most-cited scholars worldwide by Stanford-Elsevier. His awards include the URSI Young Scientist Award, the IEEE Outstanding Chapter Award, and the Punjab Innovation Research Challenge Award. His high-impact publications have been featured in Materials Horizons Emerging Investigator 2024, Nanoscale Horizons' Most Popular Article 2023, and IET MAP Top Downloaded Paper 2024. He is a Senior Member of IEEE and a member of IET, ACES, OPTICA, and SPIE. He serves/has served as an Associate Editor for IET Microwaves, Antennas & Propagation, IEEE Access, PLOS One, and Wiley International Journal of Antennas and Propagation.