Toward Sub-Millimeter Indoor Localization and Tracking at the Terahertz Band

Mohammed El-Absi
University of Duisburg-Essen, Germany

Abstract

Terahertz (THz) technologies are expected to play a central role in future wireless systems by enabling not only ultra-high data-rate communications, but also highly accurate sensing, imaging, and localization. In particular, the very large available bandwidth and the use of large antenna apertures make THz systems attractive for sub-millimeter indoor localization and tracking. However, achieving such accuracy in practical environments remains challenging due to hardware limitations, propagation losses, synchronization errors, multipath effects, and the need for dense infrastructure.

This keynote will discuss recent advances in THz-based localization with a focus on infrastructure-light and passive localization concepts. Starting from chipless RFID and passive landmark infrastructures, the talk will show how THz signals can be exploited for high-accuracy self-localization and tracking, and sensing-assisted imaging. It will also address the trade-off between localization accuracy, infrastructure density, bandwidth, and system complexity.

Biography

MOHAMMED EL-ABSI (Senior Member, IEEE) received the Ph.D. degree in electrical engineering from the University of Duisburg-Essen, Duisburg, Germany, in 2015, with summa cum laude distinction. He is currently a Senior Scientist with the Institute of Digital Signal Processing, University of Duisburg-Essen, Germany. Dr. Elabsi is a Principal Investigator in the Terahertz.NRW excellence network and a Work Package Leader in the national 6G research hub 6GEM. He is also involved in the DFG Collaborative Research Center MARIE, which addresses mobile material characterization and localization by electromagnetic sensing, and previously served as a DFG Mercator Fellow within this center. He has authored or co-authored 68 peer-reviewed publications, including 30 journal articles, in leading IEEE venues such as IEEE Transactions on Wireless Communications, IEEE Transactions on Vehicular Technology, IEEE Access, IEEE Sensors Journal, and IEEE Communications Surveys & Tutorials. His research interests include intelligent signal processing for THz/mmWave sensing and communication systems, indoor localization, ultra-massive MIMO, and 6G physical-layer design. His work focuses on statistical inference, model-based methods, and machine/deep learning techniques under realistic hardware and propagation constraints.