Title:

Advancing GNSS in Challenging Environments: From Intelligent Positioning to Ubiquitous Sensing

Abstract:

Global Navigation Satellite System (GNSS) has been widely used for civil applications, providing position, velocity, and timing information with excellent availability and economic cost. It can achieve meter or even centimetre accuracy, sufficient for most location-based services in open-sky areas. Unfortunately, the accuracy of GNSS can be easily degraded by over 50-meter errors due to environmental conditions. Specifically, GNSS signals can be scattered by buildings in urban areas, introducing multipath and non-line-of-sight (NLOS) receptions with an enormous bias during positioning, especially on the low-cost receivers. Thus, it is essential to detect and mitigate those environment-induced degradations to improve the GNSS positioning accuracy in challenging environments. In urban areas with limited measurement availability, a promising solution is to extract location-dependent features from degraded measurements to assist positioning.

In this seminar, advancements of GNSS in challenging environments will be introduced. With the 3D spatial data of the city, the GNSS signal propagation characteristics of multipath and NLOS receptions with buildings or vegetation can be modelled and simulated, enabling the prediction and correction of GNSS positioning errors in complex environments. Meanwhile, the rapid development of artificial intelligence opens new opportunities to extract hidden features from the measurement to conduct fault detection and exclusion or corrections. Moreover, the deep learning network can also explore the spatial correlation between measurements and associate with the surroundings, enabling intelligent context awareness and sensing. Finally, the potential of extending these GNSS advancements to space-borne remote sensing studies and applications in urban areas will be introduced and discussed.

About the speaker:

Guohao Zhang received his bachelor's degree in mechanical engineering and automation from University of Science and Technology Beijing, China, in 2015. He received his master's degree in Mechanical Engineering and his Ph.D. degree in Aeronautical and Aviation Engineering from The Hong Kong Polytechnic University, Hong Kong, in 2017 and 2022, respectively. He is currently an Assistant Professor with the Department of Aeronautical and Aviation Engineering, The Hong Kong Polytechnic University. His research interests include GNSS positioning in challenging environments, machine-learning-aided GNSS, signal propagation modelling, indoor positioning, and remote sensing.