Radio Resource Management in Ultra Dense Networks

Haijun Zhang

University of Science and Technology Beijing, China, haijunzhang@ieee.org

Nowadays, the mobile network no longer just connects people but is evolving into billions of devices, such as sensors, controllers, machines, autonomous vehicles, drones, people and things with each other and then achieves information and Intelligence. From a planning and optimization perspective on the mobile network, this means that we also need a lot more flexibility to address these future needs.

Next-generation (5G) wireless systems are characterized by three key features: heterogeneity, in terms of technology and services, dynamics, in terms of rapidly varying environments and uncertainty, and size, in terms of number of users, nodes, and services. The need for smart, secure, and autonomic network design has become a central research issue in a variety of applications and scenarios. Ultra-dense networks (UDN) have attracted intense interest from both academia and industry to potentially improve spatial reuse and coverage, thus allowing cellular systems to achieve higher data rates, while retaining the seamless connectivity and mobility of cellular networks. However, considering the severe inter-tier interference and limited cooperative gains resulting from the constrained and non-ideal transmissions between adjacent base stations, a new paradigm for improving both spectral efficiency and energy efficiency through suppressing inter-tier interference and enhancing the cooperative processing capabilities is needed in the practical evolution of UDN.

This tutorial will identify and discuss technical challenges and recent results related to the UDN in 5G mobile networks. The tutorial is mainly divided into four parts. In the first part, we will introduce UDN, discuss about the UDNs system architecture, and provide some main technical challenges. In the second part, we will focus on the issue of resource management in UDN and provide different recent research findings that help us to develop engineering insights. In the third part, we will address the signal processing and PHY layer design of UDN and address some key research problems. In the last part, we will summarize by providing a future outlook of UDN.