◆Title

Hybrid Processing in Massive MIMO for 5G Mobile Networks

◆Lecturer

Dr. Xiaodai Dong, Professor, University of Victoria, Canada

◆Abstract

The 5G mobile cellular network will likely employ a large number of antennas at the base station (BS). Massive multiple-input multiple-output (MIMO) is potentially one of the key technologies to achieve high capacity performance in the next generation mobile cellular systems. Despite of its high spectral efficiency in theory, the implementation of massive MIMO faces significant challenges. Each antenna in the conventional MIMO system is supported by an expensive radio frequency (RF) chain that includes analog-to-digital converter (ADC) or digital-to-analog converter (DAC), mixer for frequency downconversion or upconversion, bandpass filter, and low noise amplifier or power amplifier. When the number of antennas scales up to tens or hundreds of antennas, it is impossible to maintain an independent RF chain for each antenna, from the cost and power consumption perspective. Recently, a promising solution proposed for MIMO systems with limited RF chains is to use hybrid structures. That is, the full complexity precoding/combining operation with the number of RF chains equal to the number of antennas is now replaced by the phase shifters based analog RF processing with dimension equal to the number of antennas and digital baseband processing with low dimension equal to much fewer RF chains. In this talk, we first review the latest developments in the hybrid processing design of massive MIMO. Then a low complexity hybrid zero-forcing based precoding in massive multiuser MIMO with single antenna users will be introduced, followed by a hybrid block diagonalization processing for massive multiuser MIMO with multi-antenna users. Lastly a general near optimal hybrid processing for massive MIMO via matrix decomposition will be presented. Potential future work in this area will also be discussed.

◆Presenter Biography

Xiaodai Dong (S'97-M'00-SM’09) received her B.Sc. degree in Information and Control Engineering from Xi'an Jiaotong University, China in 1992, her M.Sc. degree in Electrical Engineering from National University of Singapore in 1995 and her Ph.D. degree in Electrical and Computer Engineering from Queen's University, Kingston, ON, Canada in 2000. Since January 2005 she has been with the University of Victoria, Victoria, Canada, where she is now a Professor at the Department of Electrical and Computer Engineering. She was a Canada Research Chair (Tier II) in 2005-2015. Between 2002 and 2004, she was an Assistant Professor at the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, AB, Canada. From 1999 to 2002, she was with Nortel Networks, Ottawa, ON, Canada and worked on the base transceiver design of the third-generation (3G) mobile communication systems.

Dr. Dong’s research interests include mobile communications, radio propagation, ultra-wideband radio, machine to machine communications, wireless security, ehealth, smart grid, THz and nano-communications and signal processing for communication applications. She served as an Editor for IEEE Transactions on Wireless Communications in 2009-2014, an Editor for IEEE Transactions for Communications in 2001-2007, Guest Editor of a Special Issue on “Physical Layer Network Coding” for EURASIP Journal on Wireless Communications and Networking (2009-2010), and Guest Editor of a Special Issue on “Communications, Computers and Signal Processing” for International Journal of Communication Networks and Distributed Systems (2011). She is currently an Editor for IEEE Transactions on Vehicular Technology.