MIMO Propagation Theory and Modeling

Prof. Yoshio Karasawa
Advanced Wireless Communication research Center (AWCC)
The University of Electro-Communications (UEC Tokyo)

This course provides an overview of recent studies on MIMO propagation theory and modeling for wideband communication systems. First, focusing on angular spread of multipath waves, wave propagation environments in mobile radio systems are discussed. A propagation channel representation of MIMO is then presented with respect to narrowband and wideband systems, and the critical role of the eigenvalue in the correlation matrix is discussed. The statistical characteristics of eigenvalues in MIMO channels are clarified by addressing cases in which the correlation between branches can be ignored and those in which it must be taken into consideration. A useful propagation simulation model called Kronecker model is also introduced. For extending an existing MIMO system to an isolated area, a MIMO repeater system becomes inevitable. For designing such a system, a multi-keyhole propagation channel model is necessary, and the model is introduced. For realizing high capacity with compact antenna system, use of multiple polarizations is promising. Channel models for dual- and tri-polarization antennas are also discussed. Finally, various MIMO transmission systems, such as STBC data transmission scheme, subband signal processing adaptive array, MIMO OFDM system, and systems robust to fast fading, are discussed from a propagation viewpoint.