

"Theory of Characteristic Modes and its Applications"

By Hiroyuki Arai, Yokohama National University

This talk presents the theory of characteristic modes (CM) given by Harrington and Mautz to show its basics and formulation in detail. A series resonance of RLC circuit, eigenmodes of CM, and natural modes are explained to show physical basics of antenna resonance. The CM analysis tools built in commercially available simulation software are also introduced with several examples. The accuracy of CM is verified by using fundamental antenna elements, such as a half wavelength dipole, one wavelength loop and rectangular microstrip antennas in terms of eigen-frequency and unloaded Q factor. In practical simulations, spurious and hybrid modes are often appeared in numerical results, in particular, due to the symmetry of antenna geometry. Mode tracking and current correlation used in the simulation improve the accuracy of CM analysis. This topic is presented by several examples. Typical applications of CM, smart phone antennas utilizing ground plane (chassis) of phone and HF antennas of platform such as aircraft and vehicle, are discussed how to use CM analysis in practical applications.