Title: High Frequency Asymptotic Methods and Applications for Electromagnetics

Full day course

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Abstract: The theory and application of various high-frequency asymptotic methods for EM analysis and design are presented at a practical level. Purely numerical methods in EM, such as the method of moments, finite element method, and finite difference methods, provide high accuracy for complex geometries, but are severely limited as the frequency increases. The computational requirements increase exponentially, so structures larger than a few wavelengths may become intractable. High-frequency asymptotic methods, on the other hand, become more accurate as the frequency increases, and the efficiency is relatively independent of frequency. These methods have the additional benefit of providing physical insight into EM radiation, propagation, and scattering. Typical applications include reflector antenna design, in-situ antenna performance analysis (gain pattern and EMI/EMC) on complex platforms, wireless propagation, radar cross-section (RCS) prediction, and multi-scale RF simulations. Several popular high-frequency methods are described and compared in some detail in this short course, including geometrical optics, physical optics, shooting and bouncing rays, iterative physical optics, physical theory of diffraction and the uniform geometrical theory of diffraction (UTD). An introduction to the NEC-BSC (Basic Scattering Code) will also be presented. The NEC-BSC applies the UTD to scattering and radiation problems for electrically large and realistically complex geometries.