ECE 793A/794 ECE GRADUATE SEMINAR
(Required for Electrophysics Area Graduate Students)
Everyone is invited to attend.

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Title: On Fast Methods for Analysis/Synthesis of Large Antenna Reflector Systems and Phased Arrays

Date: Friday, October 20, 2006
Time: 4:00 p.m.
Place: Marston 132

Abstract:
Electrically large antenna reflector systems and phased arrays are useful for very high gain communication and high resolution radar applications. The performance prediction of such antenna configurations is an important issue. Not only do the prediction or analysis tools have to be accurate, but they also have to be fast especially for optimizing the design of such antenna configurations. The latter optimization process requires one to analyze or predict the performance at each iteration till the desired design goals are met. Conventional methods of analysis become costly and time consuming, if not intractable, for the analysis/synthesis of large reflector and phased arrays. Therefore, some fast and accurate asymptotic high frequency (HF) methods will be presented for overcoming the above difficulties. Moreover, the asymptotic HF methods to be discussed also offer a simple physical picture for the wave radiation mechanisms for such electrically large antennas. In particular, a Gaussian beam (GB) expansion is developed for the feed illumination of large parabolic as well as shaped reflectors; each GB undergoes reflection and diffraction at the reflector to contribute to the reflector radiation pattern. The expressions for the reflected and diffracted GBs are obtained in closed form leading to an ultra fast analysis procedure. If the phased array aperture distribution is known from any numerical full wave solution, it is shown how this distribution can be expressed in terms of a very compact traveling wave (TW) expansion, which in turn provides the "collective" fields radiated from the entire array in terms of just a few rays of the uniform geometrical theory of diffraction (UTD). Such a fast UTD can also be combined in a hybrid fashion, with a full wave numerical integral equation solution for the array currents based on the moment method (MoM), to drastically reduce the number of unknowns otherwise present in a conventional MoM. Several numerical examples illustrating the utility of the above approaches will be presented.

Bio:
Prabhakar Pathak received his Ph.D degree from the Ohio State Univ., Columbus, Ohio, USA, in 1973. Currently he is a Professor of ECE at the Ohio State Univ. Prof. Pathak's main area of research is in the development of uniform asymptotic theories (frequency and time domain) and hybrid methods for the analysis of large electromagnetic antenna and scattering problems of engineering interest. He is recognized as one of the major contributors to the development of the uniform geometrical theory of diffraction (UTD). He was an IEEE Distinguished Lecturer from 1991 through 1993. He served as the chair of the IEEE Ant. & Prop. Distinguished Lecturer Program from '99 –'05. Prior to 1993, he also served as an Assoc. Editor of the IEEE Trans. Ant. & Prop. for two terms. He has published over a hundred journal and conference papers, as well as authored/co-authored chapters for seven books. He received the 1996 Schelkunoff best paper award from the IEEE Trans. Ant. & Prop.. Within The Ohio State University (O.S.U.), he received the George Sinclair award in 1996 for his research contributions to the O.S.U. ElectroScience Laboratory, and the Lumley Research Award in 1990, 1994 and 1998 from the O.S.U. College of Engineering. In July 2000, Prof. Pathak was awarded the IEEE Third Millennium Medal from the Ant. & Prop. Society. He was made an IEEE Fellow in 1986, and member of US Commission B of the International Union of Radio Science (URSI).