The IEEE Ottawa Antennas and Propagation Society and Microwave Theory & Techniques Society (AP/MTT) Joint Chapter, Electromagnetic Compatibility (EMC) Chapter, Components, Packaging and Manufacturing Technology (CPMT) Chapter, Communications Society, Broadcast Technology Society, and Consumer Electronics Society (ComSoc/BTS/CES) Joint Chapter, IEEE Ottawa Section (OS), and Department of Electronics (DoE) and Broadband Communications and Wireless Systems (BCWS) Research Centre at Carleton University are inviting all interested IEEE members and other engineers, technologists, and students to the IEEE Antennas and Propagation Society (AP-S) Distinguished Lectures.

DATE: Thursday, November 29, 2012.
TIME: 2:00 pm – 5:00 pm.
IEEE AP-S Distinguished Lecture (1): 2:00 pm – 3:15 pm.
Questions, Discussion, Refreshments, and Networking: 3:15 pm – 3:35 pm.
IEEE AP-S Distinguished Lecture (2): 3:35 pm – 4:50 pm.
Questions, Discussion, Refreshments, and Networking: 4:50 pm – 5:00 pm.
PLACE: Carleton University, Department of Electronics (DoE), Mackenzie Engineering Building, Room ME 4124, 1125 Colonel By Drive, Ottawa, Ontario, Canada.
ADMISSION: Free. Registration required. To ensure a seat, please contact Dr. Qingsheng Zeng (qingsheng.zeng@crc.gc.ca) or Dr. Wahab Almuhtadi (almuhtadi@ieee.org)

Dr. Tapan K. Sarkar
Full Professor
Department of Electrical and Computer Engineering
Syracuse University, Syracuse, New York, USA

Lecture (1): Electromagnetic Macro Modeling of Propagation in Mobile Wireless Communication: Theory and Experiment

Abstract

Introduction: The objective of this presentation is to illustrate that an electromagnetic macro modeling can properly predict the path loss exponent in a mobile cellular wireless communication. Specifically, we illustrate that the path loss exponent in a cellular wireless communication is three preceded by a slow fading region and followed by the fringe region where the path loss exponent is four. Theoretically this will be illustrated through the analysis of radiation from a vertical electric dipole situated over a horizontal imperfect ground plane as first considered by Sommerfeld in 1909. To start with, the exact analysis of radiation from the dipole is made using the Sommerfeld formulation. The semi-infinite integrals encountered in this formulation are evaluated using a modified saddle point method for field points moderate to far distances away from the source point to predict the appropriate path loss exponents. The reflection coefficient method can also be derived by applying a saddle point method to the semi-infinite integrals and it is shown not to provide the correct path loss exponent. The various approximations used to evaluate the Sommerfeld integrals are described for different regions. It is also important to note that Sommerfeld's original 1909 paper had no error in sign. However, Sommerfeld overlooked the properties associated with the pole. Both accurate numerical analyses along with experimental data are provided to illustrate the above statements. Both Okumura's experimental data and experimental data taken from different base stations in urban environments at two different frequencies will validate the theory. Experimental data reveal that a macro modeling of the environment using an appropriate electromagnetic analysis can accurately predict the path loss exponent for the propagation of radio waves in a cellular wireless communication scenario.

Lecture (2): Physics of Multiantenna Systems and Their Impacts on Wireless Systems

Abstract

Introduction: The objective of this presentation is to present a scientific methodology that can be used to analyze the physics of multiantenna systems. Multiantenna systems are becoming exceedingly popular because they promise a different dimension, namely spatial diversity, than what was available to the communication systems engineers: The use of multiple transmit and receive antennas provides a means to perform spatial diversity, at least from a conceptual standpoint. In this way, one could increase the capacities of existing systems that already exploit time and frequency diversity. In such a scenario it could be said that the deployment of multiantenna systems is equivalent to using an overmoded waveguide, where information is simultaneously transmitted via not only the dominant mode but also through all the higher-order modes. We look into this interesting possibility and study why communication engineers advocate the use of such systems, whereas electromagnetic and microwave engineers have avoided such propagation mechanisms in their systems. Most importantly, we study the physical principles of multiantenna systems through Maxwell's equations and utilize them to perform various numerical simulations to observe how a typical system will behave in practice. There is an important feature that is singular in electrical engineering and that many times is not treated properly in system applications: namely, superposition of power does not hold.

Speaker's Bio

Tapan K. Sarkar is Professor in the Department of Electrical and Computer Engineering, Syracuse University. His current research interests deal with numerical solutions of operator equations arising in electromagnetics and signal processing with application to system design. He has authored or coauthored more than 300 journal articles and numerous conference papers and 32 chapters in books and fifteen books, including his most recent ones, Iterative and Self Adaptive Finite-Elements in Electromagnetic Modeling (Boston, MA: Artech House, 1998), Wavelet Applications in Electromagnetics and Signal Processing (Boston, MA: Artech House, 2002), Smart Antennas (IEEE Press and John Wiley & Sons, 2003), History of Wireless (IEEE Press and John Wiley & Sons, 2005), and Physics of Multiantenna Systems and Broadband Adaptive Processing (John Wiley & Sons, 2007), Parallel Solution of Integral Equation-Based EM Problems in the Frequency Domain (IEEE Press and John Wiley & Sons, 2009), Time and Frequency Domain Solutions of EM Problems Using Integral Equations and a Hybrid Methodology (IEEE Press and John Wiley & Sons, 2010), and Higher Order Basis Based Integral equation Solver (HOBBIES) (John Wiley & Sons 2012) .

He received Docteur Honoris Causa from Universite Blaise Pascal, Clermont Ferrand, France in 1998, from Politechnic University of Madrid, Madrid, Spain in 2004, and from Aalto University, Helsinki, Finland in 2012. He received the medal of the friend of the city of Clermont Ferrand, France, in 2000.