Seminar on

The Physics and Mathematics of the Signal Propagation Mechanism in Cellular Wireless Communication Systems

by

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Date : **26 August 2016 (Friday)**
Time : **05:00 pm – 06:00 pm**
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Abstract

The objective of this talk is to introduce a new physics based visualization of the Electromagnetic wave propagation mechanism in cellular wireless communication systems. We also illustrate from a mathematical point of view that an electromagnetic macro model can accurately predict the dominant component of the propagation path loss in a cellular wireless communication. It is demonstrated using both measurements and an analytical theoretical model that the propagation path loss inside a cellular communication cell is first about 30 dB per decade of distance and later on, usually outside the cell, it is about 40 dB per decade of distance between the transmitter and the receiver irrespective of their heights from the ground. This implies that the electric field decays first at a rate of ρ—1.5 inside the cell and later on, usually outside the cell, as ρ—2, where ρ stands for the distance between the transmitter and the receiver. It will also be illustrated that the so called slow fading is due to the interference between the direct wave and the ground wave as introduced by Sommerfeld over a hundred years ago. An optical analog model will be presented based on the image theory developed by Van der Pol to illustrate the mechanism of radio wave propagation in a cellular wireless communication system where the path loss is 30 dB per decade or the field decays as ρ—1.5. This macro model is used to refine the experimental data collection system for the propagation path loss and it is also illustrated how the antenna tilt both mechanical and electrical can be incorporated in the macro model to predict the propagation path loss. Finally, an observation is made on how to further improve the propagation mechanism by observing the second channel from the mobile to the base station. Numerical and Experimental data will reveal that the proposed methodology is a much better way to deploy base station antennas.

Biography

Tapan K. Sarkar received the B.Tech. degree from the Indian Institute of Technology, Kharagpur, in 1969, the M.Sc.E. degree from the University of New Brunswick, Fredericton, NB, Canada, in 1971, and the M.S. and Ph.D. degrees from Syracuse University, Syracuse, NY, in 1975. He is now a 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 obtained one of the “best solution” awards in May 1977 at the Rome Air Development Center (RADC) Spectral Estimation Workshop. He received the Best Paper Award of the IEEE Transactions on Electromagnetic Compatibility in 1979 and in the 1997 National Radar Conference. He has authored or coauthored more than 300 journal articles and numerous conference papers and over 30 chapters in books and fifteen books,

Dr. Sarkar is a Registered Professional Engineer in the State of New York. He received the College of Engineering Research Award in 1996 and the Chancellor’s Citation for Excellence in Research in 1998 at Syracuse University. He was on the editorial board of a number of journals, Chairman of the Inter-commission Working Group of International URSI on Time Domain Metrology (1990–1996), distinguished lecturer for the Antennas and Propagation Society from (2000-2003,2011-2013), Member of Antennas and Propagation Society ADCOM (2004-2007), on the board of directors of ACES (2000-2006), Vice President of the Applied Computational Electromagnetics Society (ACES), a member of the IEEE Electromagnetics Award board (2004-2007). He is the 2014 President of the IEEE Antennas and Propagation Society. According to Google Scholar, he has a H-index of 55 with 13,485 citations to his work. He is also the president of OHRN Enterprises, Inc., a small business incorporated in New York state (1985) performing various research work for various organizations in system analysis. 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.

***** ALL ARE WELCOME *****

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