

Seminar on

Electromagnetic Macro Modeling of Propagation in Mobile Wireless Communication: Theory and Experiment

by

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Abstract

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. This represents the variation of the path loss with distance from the base station antenna. Specifically, it is illustrated 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. The size of these regions is determined on the heights of the base station antennas. Theoretically this is 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 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 extensive data taken from seven 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.

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 32 chapters in books and 15 books.

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

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City University of Hong Kong

*** ALL ARE WELCOME ***

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