

Smart Antennas
for
Wireless Communication Systems and Networks

by

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ABSTRACT

This presentation reviews antenna technology along with the associated signal processing algorithms for use in wireless communications systems. Over the last decade, there has been a growing interest on improving system capacity and increasing coverage area in wireless communications using smart antennas. Smart antenna technology is being considered for mobile platforms such as automobiles, cellular phones (mobile unit), and laptops. The results presented here are part of a larger project that considers this antenna system in the context of reconfigurable broadband (high-speed) networks. Although the design of such a system entails several other tasks (as the design of network protocols, feed network, and physical layer communications algorithms), this presentation concentrates on the antenna design and on the development of an efficient adaptive algorithm for beamforming. The objective is to design an adaptive antenna that ideally directs the maximum radiation of the pattern toward the signal-of-interest (SOI) and ideally places nulls toward the signal-not-of-interest (SNOI). The impact of a smart antenna system design on network *throughput* and communication system *BER* is also examined. Mutual coupling, which usually has a deleterious impact on the performance of a smart antenna system, can be accounted and improved performance can be achieved.

Constantine A. Balanis (S'62 - M'68 - SM'74 - F'86 – LF'04) received the BSEE degree from Virginia Tech, Blacksburg, VA, in 1964, the MEE degree from the University of Virginia, Charlottesville, VA, in 1966, and the Ph.D. degree in Electrical Engineering from Ohio State University, Columbus, OH, in 1969. From 1964-1970 he was with NASA Langley Research Center, Hampton VA, and from 1970-1983 he was with the Department of Electrical Engineering, West Virginia University, Morgantown, WV. Since 1983 he has been with the Department of Electrical Engineering, Arizona State University, Tempe, AZ, where he is now Regents' Professor. His research interests are in computational electromagnetics, smart antennas, and multipath propagation. He received in 2004 an Honorary Doctorate from the Aristotle University of Thessaloniki, the 2000 IEEE Millennium Award, the 1996 Graduate Mentor Award, Arizona State University, the 1992 Special Professionalism Award from the IEEE Phoenix Section, the 1989 IEEE Region 6 Individual Achievement Award, and the 1987-1988 Graduate Teaching Excellence Award, School of Engineering, Arizona State University.

Dr. Balanis is a Life Fellow of the IEEE. He has served as Associate Editor of the *IEEE Transactions on Antennas and Propagation* (1974-1977) and the *IEEE Transactions on Geoscience and Remote Sensing* (1981-1984), as Editor of the *Newsletter* for the IEEE Geoscience and Remote Sensing Society (1982-1983), as Second Vice-President (1984) and member of the Administrative Committee (1984-85) of the IEEE Geoscience and Remote Sensing Society, and as Distinguished Lecturer (2003-), Chairman of the Distinguished Lecturer Program (1988-1991) and member of the AdCom (1992-95, 1997-1999) of the IEEE Antennas and Propagation Society. He is the author of *Antenna Theory: Analysis and Design* (Wiley, 1982, 1977, 2005) and *Advanced Engineering Electromagnetics* (Wiley, 1989).