

“ADVANCED WIRELESS PRODUCT DESIGN”

From Components to Smart Antenna Systems

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The ultimate objective of this talk is to propose research and development activities toward the achievement of the more advanced electromagnetic design capabilities required to address future industrial and consumer electronics products, particularly wireless products.

In order to elucidate the need for better design capabilities, the talk starts with the description of some advanced antenna concepts for wireless devices. The examples are chosen so that they span the fundamental electromagnetic principles from electrically small to Smart or Multiple Input Multiple Output (MIMO) antennas. Recently, the number of papers on “antenna miniaturization” has dramatically increased. The performance trade-offs involved with miniaturization of antennas and key principles for robust comparisons are briefly reviewed. Miniaturization and product complexity point toward interdisciplinary design. Moreover, in Smart Antenna systems, the multiple antennas are used to provide additional design degrees of freedom to optimize more advanced communications systems. Some of the peculiarities of MIMO antenna performance are described, especially as they relate to the propagation environments that they operate in. System performance metrics, such as Bit Error Rate, are discussed as they are more relevant than traditional antenna metrics. MIMO systems point toward cross-layer design and optimization.

The talk concludes with a proposed framework for Multidisciplinary Optimization and Cross-Layered Design. This framework outlines a structure and requirements for the participating software tools. Additionally, requirements on electromagnetic solvers are described so that they can handle these new complex tasks. In particular, the exciting new field of domain decomposition is mentioned and extensions that could simultaneously address geometric complexity and full wave solution of large antenna arrays encountered in MIMO systems.



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Nick Buris received the diploma of Electrical Engineering in 1982 from the National Technical University of Athens, Greece and the Ph.D. in Electrical Engineering from the North Carolina State University, Raleigh, NC in 1986. In 1986 he was a visiting professor at NCSU working on space reflector antennas for NASA. In 1987 he joined the faculty of the department of Electrical and Computer Engineering at the University of Massachusetts at Amherst. His research work there spanned the areas of microwave magnetics, phased arrays printed on ferrite substrates and broadband antennas. In the summer of 1990 he was a faculty fellow at the NASA Langley Research Center working on calibration techniques for dielectric measurements and an ionization (plasma) sensor for an experimental reentry spacecraft.

In 1992 he joined the Applied Technology organization of Motorola's Paging Product Group and in 1995 he moved to Corporate Research to start an advanced modeling effort. At Motorola he has worked on several projects from product design to measurement systems and the development of proprietary software tools for electromagnetic design. He currently manages the Microwave Technologies Research Lab within Motorola Labs in Schaumburg, IL. Recent activities of the group include high frequency communications systems design, modeling and measurements of complex electromagnetic problems, RF Propagation, Smart Antennas/MIMO, RFID systems as well as TIA standards work on RF propagation and RF exposure.

Nick is a senior member of the IEEE, and serves on a MIT Technical Program Committee. He recently served as chair of a TIA committee on RF exposure and is currently a member of its Research Division Committee.