



Nanotechnology Seminar Series

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“Applications of Frequency Selective Surfaces in the Design of Metamaterials”

Tuesday, December 19, 2006

3:45 PM

Birck Nanotechnology Building, Room 2001

Douglas H. Werner, Professor and Director

The Computational Electromagnetics and Antennas Research Lab (CEARL)

Pennsylvania State University, Department of Electrical Engineering,

<http://labs.ee.psu.edu/labs/dwerner/>

Frequency Selective Surfaces (FSS) are well known in the literature for their filtering characteristics at microwave and millimeter wave frequencies. Traditional FSS filters are comprised of a doubly periodic metallic screen printed on a dielectric substrate and are sometimes referred to in the infrared (IR) as metallodielectric photonic crystals (MDPCs). Metallodielectric FSS have also been synthesized at microwave frequencies to exhibit metamaterial properties such as artificial magnetic conducting, negative refractive index and zero refractive index behavior. This research naturally extends to synthesizing negative index metamaterials (NIM) and zero index metamaterials (ZIM) in the IR and optical bands. For applications at visible wavelengths, metallic losses can degrade the performance of metallodielectric FSS, whereas low loss dielectric materials are readily available. Thus, all-dielectric FSS (DFSS) are also being investigated for filtering applications in the near-IR and optical regimes. This talk will provide an overview of research in the area of FSS-based metamaterials, with an emphasis on work being done at the Pennsylvania State University Computational Electromagnetics and Antennas Research Lab (PSU CEARL). Other types of novel metamaterials under development by the PSU CEARL group will also be discussed. An emphasis will be placed on the computational modeling tools developed specifically for the analysis and design optimization of electromagnetic metamaterial performance.

Dr. Douglas H. Werner received the B.S., M.S., and Ph.D. degrees in electrical engineering and the M.A. degree in mathematics from The Pennsylvania State University (Penn State), University Park, in 1983, 1985, 1989, and 1986, respectively.

He is a Professor in the Pennsylvania State University, Department of Electrical Engineering. He is also the director of the Computational Electromagnetics and Antennas Research Lab (CEARL) <http://labs.ee.psu.edu/labs/dwerner/> as well as a member of the Communications and Space Sciences Lab (CSSL). He is also a Senior Scientist in the Computational Electromagnetics Department of the Applied Research Laboratory and a faculty member of the Materials Research Institute (MRI) at Penn State. Dr. Werner was presented with the 1993 Applied Computational Electromagnetics Society (ACES) Best Paper Award and was also the recipient of a 1993 International Union of Radio Science (URSI) Young Scientist Award. In 1994, Dr. Werner received the Pennsylvania State University Applied Research Laboratory Outstanding Publication Award. He was a co-author (with one of his graduate students) of a paper published in the IEEE Transactions on Antennas and Propagation which received the 2006 R. W. P. King Award. He has also received several Letters of Commendation from the Pennsylvania State University Department of Electrical Engineering for outstanding teaching and research. Dr. Werner is a former Associate Editor of Radio Science, an Editor of the IEEE Antennas and Propagation Magazine, a Fellow of the IEE and the IEEE, a member of the American Geophysical Union (AGU), URSI Commissions B and G, the Applied Computational Electromagnetics Society (ACES), Eta Kappa Nu, Tau Beta Pi and Sigma Xi. He has published numerous technical papers and proceedings articles and is the author of eight book chapters. He edited a book entitled *Frontiers in Electromagnetics* (Piscataway, NJ: IEEE Press, 2000). He has also contributed a chapter for a book entitled *Electromagnetic Optimization by Genetic Algorithms* (New York: Wiley Interscience, 1999) as well as for the book entitled *Soft Computing in Communications* (New York: Springer, 2004). He has recently completed work on a new book (co-authored with Randy Haupt) entitled *Genetic Algorithms in Electromagnetics* to be published by Wiley. He has also recently completed an invited chapter on “Fractal Antennas” for the new edition of the popular *Antenna Handbook* published by McGraw-Hill. He was the recipient of a College of Engineering PSES Outstanding Research Award and Outstanding Teaching Award in March 2000 and March 2002 respectively. He was also recently presented with an IEEE Central Pennsylvania Section Millennium Medal.

His research interests include theoretical and computational electromagnetics with applications to antenna theory and design, phased arrays, microwave devices, wireless and personal communication systems, wearable and e-textile antennas, frequency selective surfaces, electromagnetic wave interactions with complex media, metamaterials, electromagnetic bandgap materials, zero and negative index materials, fractal and knot electrodynamics, tiling theory, neural networks, genetic algorithms and particle swarm optimization.

Host: Vlad Shalaev, Electrical and Computer Engineering Department, (49855, shalaev@purdue.edu)

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