



**Southeastern Michigan Section
"Chapter IV" Speaker Series
Thur., November 11, 2010, 4:00 pm
Room #1670, CSE Bldg,
North Campus, University of Michigan
1301 Beal Ave, Ann Arbor, MI**



"Taming Light and Electrons with Metamaterials"

Nader Engheta

H. Nedwill Ramsey Professor of Electrical and Systems Engineering, and Professor of Bioengineering, at the University of Pennsylvania

Abstract:

Imagine lumped circuit elements that could work with light at the nanoscale instead of electrons! What could you do with such optical nanocircuits? Would you be able to use them in wireless gadgets at nanoscales that may connect our nanoworlds? May these tiny optical nanocircuits be coupled with biological entities and thus provide hybrid sensors in the future? The fields of metamaterials and nanooptics may provide road maps for such futuristic nanocircuits, nanosystems and devices. In my group, we have been developing and investigating some of the fundamental concepts and theories, and key principles of such metamaterial nanostructures, devices, and nanocircuits. When we combine the two phenomena of extreme-parameter metamaterials with the fields of nanooptics and nanoelectronics, various interesting possibilities may arise. Optical nanocircuitry is one of the several outcomes of such combination of these fields, and represents a case study for general unification of paradigms/technologies of "electronics", "photonics", and "magnetics" under one umbrella. This field, which I call metatronics, addresses metamaterial-inspired optical nanocircuits and nanosystems (N. Engheta, *Physics World*, 23(9), 31, 2010; N. Engheta, *Science*, 317, 1698-1702, 2007). In my group, a variety of ideas and paradigms for nanocircuit functions, optical antennas and sensors for beam shaping and photonic wireless at the nanoscale, graphene circuitry at IR wavelengths, control of one-way flow of photons and electrons in desired directions, nanospectrometer for molecular spectroscopy, nanotagging and barcodes based on these optical circuits are being studied. In this talk, I will give a sample of some of these studies in my group, present insights into these findings, and forecast future ideas and road maps in these areas.

Speaker's Biography:

Nader Engheta is the H. Nedwill Ramsey Professor of Electrical and Systems Engineering, and Professor of Bioengineering, at the University of Pennsylvania. He received his B.S. degree in EE from the University of Tehran, and his M.S and Ph.D. degrees in EE from Caltech. Selected as one of the *Scientific American Magazine* 50 Leaders in Science and Technology in 2006 for developing the concept of optical lumped nanocircuits, he is a Guggenheim Fellow, an IEEE Third Millennium Medalist, and a Fellow of IEEE, APS, OSA, and American Association for the Advancement of Science (AAAS), and the recipient of several research awards including the 2008 George H. Heilmeier Award for Excellence in Research from UPenn, the Fulbright Naples Chair Award, NSF Presidential Young Investigator award, the UPS Foundation Distinguished Educator term Chair, and several teaching awards including the Christian F. and Mary R. Lindback Foundation Award, S. Reid Warren, Jr. Award, and W. M. Keck Foundation Award. His current research activities span a broad range of areas including metamaterials and plasmonic optics, nanooptics and nanophotonics, graphene optics, biologically-inspired sensing and imaging, miniaturized antennas and nanoantennas, physics and reverse-engineering of polarization vision in nature, mathematics of fractional operators, and physics of fields and waves phenomena. He has co-edited the book entitled "Metamaterials: Physics and Engineering Explorations" by Wiley-IEEE Press, 2006.