USC Viterbi
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Ming Hsieh Department of Electrical Engineering

Ming Hsieh Institute Seminar Series
Ming Hsieh Department of Electrical Engineering

Integrated Systems

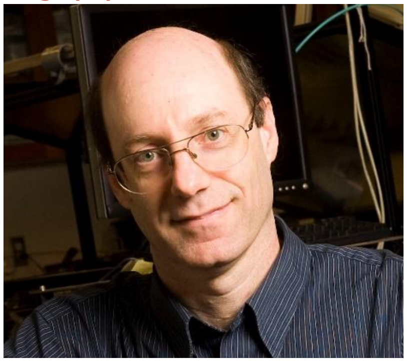
Engineering Systems with Metamaterials

Dr. David R. Smith
Professor, Duke University

Date: Friday, February 1st, 2019 - Time: 2:00pm - Location: EEB 132

Abstract: It has been nearly twenty years since the term "metamaterial" was coined and the demonstration in 2000 by our group of an artificially structured metamaterial with a negative index-of-refraction. This demonstration spurred enormous interest in metamaterials as a means of achieving material response not available in conventional materials, leading to many new material concepts. This line of research peaked with the development of transformation optics and the demonstration of a metamaterial "invisibility cloak." Yet, as exciting and novel as they were, most of these highly compelling metamaterial concepts did not translate to viable applications, leaving them in the realm of fascinating and thought-provoking science. In more recent years, our group has focused on applying the fundamental techniques of metamaterial design to engineered systems, finding new routes to device and system design enabled by the metamaterial approaches. The constituent elements of metamaterials can be equated to the atoms or molecules of conventional materials, which are typically described by their dipolar response. This specific aspect of metamaterials can be used to form a framework for engineered materials and surfaces, which can be reduced both conceptually and physically to collections of interacting polarizable electric and magnetic dipoles. This coupled dipole approach provides a basis for the accurate design and modelling of electrically large devices, providing new insights and leading to new architectures for many types of systems. The metamaterial approach has been applied to the design of apertures for use in such fields as satellite communications, radar, and microwave imaging. I will discuss the emerging metamaterial approach to engineering, with specific examples from our own work on antennas and millimeter wave imaging systems.

Biography:



Dr. David R. Smith is the James B. Duke Distinguished Professor of the Electrical and Computer Engineering Department at Duke University, where he also serves as Director for the Center for Metamaterial and Integrated Plasmonics. Dr. Smith is also the Founding Director of the Metamaterials Commercialization Center at Intellectual Ventures in Bellevue, Washington. He holds a secondary faculty appointment in the Physics Department at Duke University and is a Visiting Professor of Physics at Imperial College, London, Dr. Smith received his Ph.D. in 1994 in Physics from UCSD. Dr. Smith's research interests include the theory, simulation and characterization of unique structures across the electromagnetic spectrum, including photonic crystals, metamaterials and plasmonic nanostructures. Smith has over 300 publications in the area of metamaterials, and more than 70 patents and patent filings. Smith and his colleagues demonstrated the first left-handed (or negative index) metamaterial at microwave frequencies in 2000. In 2006, Smith and colleague Sir John Pendry reported a new electromagnetic design approach, now termed transformation optics, and suggested the possibility of a metamaterial "invisibility" cloak. Smith's group subsequently demonstrated a metamaterial "invisibility cloak" later in 2006. Dr. Smith was part of a five member team that received the Descartes Research Prize in 2005, awarded by the European Union, for contributions to metamaterials and other novel electromagnetic materials. Continually since 2009, Dr. Smith has been named a "Citation Laureate" by Clarivate Analytics Web of Science, for having among the most number of highly cited papers in the field of Physics. Dr. Smith is a co-recipient of the McGroddy Prize for New Materials, awarded by the American Physical Society, for "the discovery of metamaterials" (2013). In 2016, Dr. Smith was elected to the National Academy of Inventors. Dr. Smith has recently been active in transitioning metamaterial concepts for commercialization, being a co-founder of Evolv Technology, Echodyne Corporation, Pivotal Communications, and advisor to Kymeta Corporation and Lumotive Corporation—all companies devoted to developing metamaterial products. Most recently, Dr. Smith has led efforts to apply metasurface apertures for use in security screening using millimeter waves. Dr. Smith currently serves as CEO of Metacept Corporation, a new startup that provides analysis, design and general support in the area of metamaterial design.

Hosted by Prof. Hossein Hashemi, Prof. Mike Chen, Prof. Dina El-Damak, and Prof. Mahta Moghaddam.
Organized and hosted by Aoyang Zhang (aoyangzh@usc.edu).