IEEE (HK) Section
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State Key Laboratory of
Terahertz and Millimeter Waves
香港城市大學
City University of Hong Kong

Seminar

The Physics and Engineering of Metamaterial-inspired Electrically Small Directive Antennas and Their NextG Applications

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Date: Thursday 12 May, 2022
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Venue: Online
Registration link: https://events.vtools.ieee.org/event/register/313539

Abstract

The introduction of metamaterials and metamaterial-inspired structures into the tool set of RF engineers has led to a wide variety of advances within research and application areas treating structures that radiate (e.g., RF antennas) and scatter (e.g., optical nano-antennas). The increased awareness of complex media, both naturally occurring and artificially constructed, which has been stimulated by the debut of metamaterials, has enabled paradigm shifts in terms of our understanding of how devices and systems operate and our expectations of their performance characteristics. These shifts include the trends of miniaturization, enhanced performance (total radiated power, bandwidth and directivity), reconfigurability and multifunctionality. New techniques have been developed that are truly beginning to impact practical realizations and their applications.

A variety of metamaterial-inspired, near-field resonant parasitic (NFRP), electrically small antennas have been developed that exhibit multifunctional performance, enhanced bandwidths, and higher directivities. Their engineering is achieved by combining multiple NFRP elements with simple driven radiators. Higher directivity is obtained by simultaneously exciting balanced electric and magnetic NFRP elements, leading, for example, to endfire and broadside radiating Huygens dipole antennas (HDAs). Enhanced bandwidths and loss mitigation, as well as wireless power transfer capabilities, have been achieved by augmenting the HDAs with non-Foster (active) and rectifying (rectenna) elements. A variety of HDAs have been fabricated and tested to confirm their attractive performance characteristics; they will be reviewed briefly. Most recently, both beam steerable linear arrays of HDAs and higher-order multipole single-port antennas have been demonstrated to be in good agreement with their analytical and numerical predictions. These Huygens dipole antenna arrays (HDAAs) and Huygens multipole antennas (HMAs) will also be described. The potential of the HDAs, HDAAs and HMAs for the much anticipated NextG electromagnetic ecosystems and associated IoT applications will be stressed throughout my presentation.

Biography

Richard W. Ziolkowski received the B. Sc. (magna cum laude) degree (Hons.) in physics from Brown University, Providence, RI, USA, in 1974; the M.S. and Ph.D. degrees in physics from the University of Illinois at Urbana-Champaign, Urbana, IL, USA, in 1975 and 1980, respectively; and an Honorary Doctorate degree from the Technical University of Denmark, Kongens Lyngby, Denmark in 2012.

He is currently a Distinguished Professor in the Global Big Data Technologies Centre in the Faculty of Engineering and Information Technologies (FEIT) at the University of Technology Sydney, Ultimo NSW Australia. He became a Professor Emeritus at the University of Arizona in 2018, where he was a Litton Industries John M. Leonis Distinguished Professor in the Department of Electrical and Computer Engineering in the College of Engineering and was also a Professor in the College of Optical Sciences. He was the Computational Electronics and

Electromagnetics Thrust Area Leader with the Engineering Research Division of the Lawrence Livermore National Laboratory before joining The University of Arizona, Tucson, AZ, USA, in 1990.

Prof. Ziolkowski was the recipient of the 2019 IEEE Electromagnetics Award (IEEE Technical Field Award). He is an IEEE Life Fellow as well as a Fellow of OPTICA (previously the Optical Society of America, OSA) and the American Physical Society (APS). He was the 2014-2015 Australian DSTO Fulbright Distinguished Chair in Advanced Science and Technology. He served as the President of the IEEE Antennas and Propagation Society (AP-S) in 2005 and has had many other AP-S leadership roles. He is also actively involved with the International Union of Radio Science (URSI), the European Association on Antennas and Propagation (EurAAP), and the International Society for Optics and Photonics (SPIE) professional societies. He is the co-Editor of the best-selling 2006 IEEE-Wiley book, Metamaterials: Physics and Engineering Explorations.

***** ALL ARE WELCOME *****

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