

Affordable Phased-Array Antenna Technology Exploiting Reconfigurable Metamaterials

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Abstract: There is a growing interest in employing phased-array antennas in various applications ranging from satellite and airborne imaging systems to radar, communications, and electronic warfare systems. While a number of phased-array systems have been deployed, their extreme cost and complexity have limited their application only to the most expensive pieces of military hardware. Therefore, many systems that can potentially benefit from the capabilities offered by phased arrays are left behind. To enable the widespread use of phased-array antenna technology in such systems, techniques for development of affordable phased arrays are needed.

In this presentation, I will first give an overview of the research conducted in the Applied Electromagnetics area at UW-Madison to address various challenges in the areas of wireless communications, high-power microwaves, antennas, infrared systems, and medicine. Then, I discuss a possible solution to the problem of affordable phased array antenna technology that we have worked on over the past decade. This solution relies on developing tunable metamaterials and periodic structures and using them in designing reconfigurable reflect- and transmit-arrays, capable of providing adaptive beam steering. I will present various examples broadband, reflect- and transmit-arrays developed in our group and discuss methods that we have examined to make these structures tunable. Finally, I will conclude the presentation by introducing the concept of MAcro-Electro-Mechanical-Systems (MÆMS) based beam steering in reflectarray antennas as a promising candidate for addressing the problem of affordable phased-array antenna technology.

Biography: Nader Behdad received the B.S. degree in Electrical Engineering from Sharif University of Technology (Tehran, Iran) in 2000 and the M.S. and Ph.D. degrees in Electrical Engineering from University of Michigan - Ann Arbor in 2003 and 2006, respectively. Currently he is an Associate Professor in the Department of Electrical and Computer Engineering and the Harvey D. Spangler Faculty Scholar in the College of Engineering of the University of Wisconsin-Madison. From 2009-2013 he was an Assistant Professor in the Department of Electrical and Computer Engineering of the University of Wisconsin and from 2006 to 2008, he was as an Assistant Professor in the Department of Electrical Engineering and Computer Science of the University of Central Florida in Orlando, FL. Dr. Behdad's research expertise is in the area of applied electromagnetics. In particular, his research interests include electrically-small antennas, antenna arrays, antennas for biomedical applications, biomedical applications of RF/microwaves, periodic structures, frequency selective surfaces, passive high-power microwave devices, metamaterials, and biomimetics and biologically inspired systems in electromagnetics. Over the years, Dr. Behdad's research has been sponsored by various U.S. Federal agencies including the U.S. Navy, Air Force, National Science Foundation, and the National Institute of Health.