



Georgia Tech

Georgia Electronic
Design Center

Distinguished Lecture Series



Beam-Steering and Beam-forming with Metasurfaces and Metastructures



Dr. George Eleftheriades
Professor
University of Toronto

Tuesday, October 29, 2024
11:00 a.m. - 12:00 p.m.
Location: TSRB 118 Auditorium

Abstract: Recent advances in metasurfaces and metastructures will be presented for achieving electromagnetic-wave beam-steering and beam-shaping in the far zone. First, we will present a paradigm shift on how to implement reflecting surfaces that can provide complete control of the reflected wave, thus enabling both beam-steering and beam-shaping, without the explicit need of loss or gain. The key enabling feature is the utilization of surface waves to both change the phase of the reflected wave but also allow for amplitude control through power redistribution. We will showcase several such surface-wave assisted metasurfaces, including multi-beam ones, ones with shaped reflected beams, electrically-thin reflectors with low-beam squinting vs. frequency, and electronically reconfigurable ones. In the second part of the presentation, we will showcase some metastructures that can compete with traditional phased arrays but have a lower overall cost. For example, we will show how a mixer-fed array can generate the phase profile required to fully scan a beam, and how the beam can be shaped across each principal plane. In this architecture, the number of phase shifters required is dramatically reduced leading to an overall reduced cost.

Bio: George V. Eleftheriades is a Professor in the Department of Electrical and Computer Engineering at the University of Toronto Canada where he holds the Velma M. Rogers Graham Chair in Engineering. Prof. Eleftheriades introduced the concept of using transmission lines to realize negative-index metamaterials in 2002. More recently, he pioneered “field discontinuity” metasurfaces, 2D analogues of metamaterials, and their antenna applications. Professor Eleftheriades received the 2008 IEEE Kiyoo Tomiyasu Technical Field Award, the 2015 IEEE AP-S John Kraus Antenna Award, the 2019 IEEE Antennas and Propagation Society’s Distinguished Achievement Award, and the 2025 IEEE Electromagnetics Award. He is an IEEE Fellow, a Fellow of the Canadian Academy of Engineering and a Fellow of the Royal Society of Canada (Academy of Sciences). His research interests include electromagnetic and optical metamaterials, metasurfaces for 6G, antennas and components for wireless communications, novel antenna beam-steering techniques, far-field super-resolution imaging, plasmonic and nanoscale optical components, and fundamental electromagnetic theory.

Host: Dr. Nima Ghalichechian

Pizza and soda will be provided