

From EBG's to Meta-Surfaces and Beyond: Recent Developments and Novel Engineering Applications

Yahya Rahmat-Samii

University of California Los Angeles, ECE Department Los Angeles, CA 90095-1594, USA

E-mail: rahmat@ee.ucla.edu

Abstract

It has been over a quarter of a century that modern engineered materials have found their ways in manipulating electromagnetic waves. Advanced prototyping approaches and sound theoretical developments attracted many researchers worldwide to contribute and suggest novel devices with out-of-the-box characteristics. There exist now many applications in diverse areas of electromagnetics engineering and antenna designs that researchers and engineers are excited to utilize the so-called “meta-materials” as part of their design tool kits. From frequency selective surfaces (FSS) to electromagnetic band-gap (EBG) ground planes, from impedance boundaries to Huygens metasurfaces, novel electromagnetic structures have been emerging in both microwaves and optics. Many intriguing phenomena occur within and on the surfaces of these structures with profound utilizations in practical applications such as low profile antennas, reflectarrays, transmitarrays, bending lights, orbital angular momentum beams, etc. This plenary talk will review the development of various electromagnetic meta-structures, as well as the state-of-the-art concepts, designs and manufacturing techniques including Fused Deposition Modeling (FDM), Stereolithography (SLA), Direct Metal Laser Sintering (DMLS), Inkjet printing and Charge-Programmed Multi-material 3D Printing. Furthermore, a wealth of practical examples will be presented to illustrate promising applications of these intriguing concepts. Representative materials will also be presented from two recent books, “*Surface Electromagnetics: With Applications in Antenna, Microwave and Optical Engineering*”, Eds. F. Yang and Y. Rahmat-Samii, Cambridge University Press, 2019, and “*Electromagnetic Band Gap Structures in Antenna Engineering*”, F. Yang and Y. Rahmat-Samii, Cambridge University Press, 2009.