Seminar Talk

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Tuesday, January 31, 2017
3:00 p.m. KH 224

Title: Electromagnetic scattering characteristics of metamaterials

Abstract:
The study of the electromagnetic (EM) scattering characteristics of metamaterials in the vicinity of conducting geometries is of tremendous interest to the scientific community. The objective of this discussion is to present a theoretical analysis of the scattering characteristics of these metamaterials in the vicinity of conducting surfaces for different geometries and arrangements. This study will contribute towards advancements in the areas of cloaking, low observable antenna design, remote sensing and sensor devices in the microwave regime (operating between 1 - 10 GHz). The metamaterials considered in this study are of both dispersive and non-dispersive types. The dispersive type metamaterials are simulated by substituting the Drude/Lorentz model for the permittivity and the permeability of the material. The non-dispersive type has fixed values for the same parameters for the entire spectrum. In the first part of the analysis, the scattering characteristics of a metamaterial coated conducting cylinder with an intervening air gap will be presented. Subsequently, the scattering characteristics of a metamaterial coated conducting sphere with an intervening air gap will be presented. In reality, these air gaps may be implemented by styrofoam which has approximately the same dielectric characteristics as that of air (ε_r=1.03). For both cylindrical and spherical cases, plane wave incidence has been considered. It can be shown that broadband reduction of backscattering and reduction of total scattering for a broad range of scattering angles are possible to achieve, thus giving astonishing results for cloaking and scattering reduction applications. In the final portion of this presentation, the scattering characteristics of a dispersive and lossy or non-dispersive metamaterial sphere or metamaterial coated conducting sphere in the vicinity of a conducting surface with the surrounding medium being air is presented. A technique based on method of images and multipole expansions is utilized to obtain the scattering characteristics for a circularly polarized (left or right) incident beam. The results show interesting possibilities for remote sensing and low observable antenna and radar applications for maritime purposes.

Bio:
Dr. Adnan Jamil is an application engineer with Altair Engineering in Hampton, Virginia. He completed his PhD in the early part of 2016 from the University of Massachusetts at Lowell. He also has a B.S. (2004) and M.S. (2007) in Electrical Engineering. His area of expertise is in

theoretical and computational Electromagnetics. His other academic interests are in communications and optics. Adnan has contributed to product development in companies like Motorola and Samsung. He has published in prestigious journals during his PhD degree tenure and plans on continuing. During his free time he likes to follow sports and travel.