Use of Equivalent Metamaterial Parameters in Finite Element Models of Macro-scale Metamaterial

Bulletin of the American Physical Society

APS March Meeting 2018
Volume 63, Number 1
Monday–Friday, March 5–9, 2018; Los Angeles, California

Session F09: Dielectric and Ferroic Oxides - New Materials
11:15 AM–2:15 PM, Tuesday, March 6, 2018
LACC Room: 301A

Sponsoring Unit: DMP
Chair: Wei Ren, Shanghai University

Abstract ID: BAPS.2018.MAR.F09.9

Abstract: F09.00009 : Use of Equivalent Metamaterial Parameters in Finite Element Models of Macro-scale Metamaterial*
1:15 PM–1:27 PM

Abstract

Presenter:
Dragoslav Grbovic
(Physics, Naval Postgraduate School)

Authors:
Dragoslav Grbovic
(Physics, Naval Postgraduate School)

Fabio Alves
(Physics, Naval Postgraduate School)

Richard Mattish
(Physics, Bob Jones University)

Experimentally measured reflectance and transmittance are used to obtain effective permittivity, permeability and conductivity for a planar microwave metamaterial. These parameters are then used in a finite element models of macro-scale metamaterial objects, where the metamaterial is represented as a homogeneous layer with frequency-dependent permittivity, permeability and conductivity. We demonstrate good agreement between reflectance and absorbance of metamaterial structure and those obtained from modeling homogenized, macro-scale metamaterials. We further demonstrate use of the method for geometrically scaled, oddly-shaped macroscopic objects. This method significantly reduces computation requirements and enables modeling of metamaterial-made, large area objects without modeling their actual intricate metamaterial structure.

*This work was sponsored by the Office of Naval Research (ONR), under grant (or contract) number N0001416WX01128.