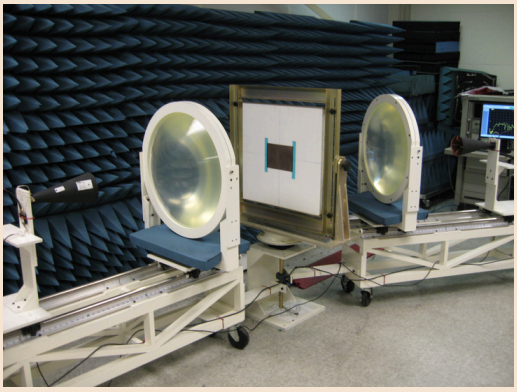
SC12-Plane Waves in Anisotropic and Bianisotropic Media



Abstract

Fabrication capabilities, such as 3D printing, has allowed the rapid prototyping of ever exotic materials, such as anisotropic and bianisotropic media. These materials allow substantially more control over the electromagnetic field as compared to simple media, thus leading to new applications and devices. However, electromagnetically characterizing these materials requires both theoretical analysis and experimental validation. The focus of this short course is to understand how electromagnetic plane waves scatter from these complex materials using a unified eigen-analysis formulation. A future short course will address the experimental aspects of experimental material characterization, especially with a focused-beam system capable of generating plane waves in a diverse environment.

Recommended prerequisites

The attendees should have a basic understanding of Maxwell's equations and plane waves in simple media. A basic background in linear algebra. Experience with finding eigenvalues and eigenvectors is beneficial.

Learning objectives

The primary learning objectives/goals are:

1. Extend the understanding of plane waves interacting with simple media taught in typical electromagnetics courses to plane waves interacting with complex media (i.e., biisotropic, anisotropic, and bianisotropic media).
2. Provide a unified methodology for treating plane waves propagating in non-simple media via an eigen-analysis formulation.
3. Compute reflection and transmission coefficients of complex-media slabs, thus setting the stage for future material extraction techniques.
4. Discuss the advantages of complex media (e.g., polarization control, etc.) and challenges.

Course outline

Electronic pdf notes will be provided, thus a laptop is required.
If the author understand correctly, the short course will be 3 hours long with a 30 minute break in between. The technical portion of the outline of the proposed tutorial short course is below:

1. Motivation for investigating anisotropic and bianisotropic media.
2. Brief review of Maxwell's equations and bianisotropic constitutive relations.
3. Discussion of a unified plane-wave eigen-analysis formulation capable of handling general bianisotropic media.
4. Examples of electromagnetic waves propagating in simple, biisotropic, anisotropic, and bianisotropic media.
5. Conclusions and future work.

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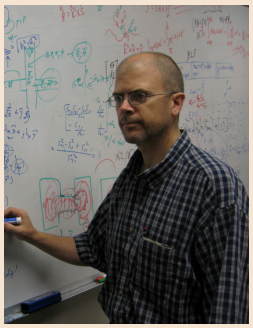

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