Attention has been focused on electromagnetic chirality and its potential applications to microwave, millimeter wave and optical wave devices. In this work, wave propagation through a chiral periodic structure with arbitrary shape is investigated.

Although perturbation theory and coupled-mode theory have been used to analyze chiral periodic structure, those are approximate methods and can only be used for low frequency applications. In this work, the rigorous mode-matching method is used to solve the problem. Staircase approximation is introduced to change the curved structure to a multilayer structure. The field solutions in the uniform air regions and unbounded air-chiral periodic array have been derived. Finite element method is used to solve the eigenvalues and eigenfunctions in the periodic chiral slabs. Mode-matching method is used at the boundaries to calculate the scattering characteristics. Numerical results are displayed to explain the underlying physical properties of the chiral periodic structure. The Wood's anomalies at high frequencies have been investigated and explained by the excitation of leaky waves guided along the periodic layer. The influence of frequency, chirality parameter, incident angle, curve shape and period are discussed. It has been found that the chiral periodic structure can be used as both a frequency selective device and a mode conversion device. First, the derivation and numeric calculation were done with the principle plane incidence. Then, the discussion was extended to the more general case of oblique incidence by the coordinate transformation.

Major: Electrical Engineering

Educational Career:
Bachelor's of Electrical Engineering, BS, 1994, Northwestern Polytechnical University, China
Master's of Electrical Engineering, MS, 2001, University of Central Florida

Committee in Charge:
Thomas Wu, Chair, School of Electrical Engineering and Computer Science
Parveen Wahid, School of Electrical Engineering and Computer Science
Issa Batarseh, School of Electrical Engineering and Computer Science
Wendell Brokaw, EmSine LLC

Approved for distribution by Thomas Wu, Committee Chair, on October 20, 2009.

The public is welcome to attend.