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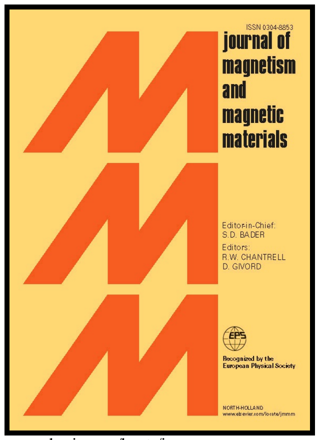

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Analysis and Synthesis of One-Dimensional Magneto-Photonic Crystals Using Coupled Mode Theory

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Abstract

We utilize our previously developed temporal coupled mode approach to investigate the performance of one-dimensional magneto-photonic crystals (MPCs). We analytically demonstrate that a double-defect MPC provides adequate degrees of freedom to design a structure for arbitrary transmittance and Faraday rotation. By using our developed analytic approach along with the numerical transfer matrix method, we present a procedure for synthesis of an MPC to generate any desired transmittance and Faraday rotation in possible ranges. However it is seen that only discrete values of transmittance and Faraday rotation are practically obtainable. To remedy this problem along with having short structures, we introduce a class of MPC heterostructures which are combinations of stacks with high and low optical contrast ratios.

Keywords: Magneto-photonic crystal (MPC), Faraday rotation, Magneto-optics, Coupled mode theory, MPC synthesis, MPC heterostructure.

1. Introduction

Magneto-photonic crystals (MPCs) are formed when magnetic materials are introduced into photonic crystal (PC) structures. Cavity-type MPCs which contain one or more magnetic defects can significantly enhance Faraday/Kerr rotation of the transmitted/reflected lightwave due to the strong concentration of light within the defects. One-dimensional (1D) MPCs have been greatly considered because they are attractive to realize fast and thin film-type magneto-optical (MO) devices for use in