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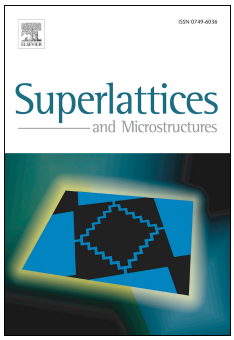

Properties of dispersion and phase index in magnetized one dimensional ferrite photonic crystals in longitudinal configuration for TM mode

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Properties of dispersion and phase index in magnetized one dimensional ferrite photonic crystals in longitudinal configuration for TM mode

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Abstract:

The band structure and phase index in magnetized one dimensional ferrite photonic crystals are computed for TM mode in longitudinal configuration using transfer matrix method. The parametric studies are performed to investigate the effect of filling factor, incident angle and external magnetic fields on dispersion and phase index of the considered structure. The variation of frequency and filling factor at fixed normalized parallel wave vector shows that photonic band gaps occur in the form of lobes. The variation of frequency with external magnetic fields at different normalized parallel wave vector shows that effect of the external magnetic fields have strong influence on second and higher order photonic band gaps. The phase index is also found to be sensitive function of filling factor and normalized parallel wave vector.

Keywords: Ferrite photonic crystal, photonic band gaps, Brewster angle, filling factor, dispersion curve, phase index.

1. Introduction

Photonic crystals (PhCs) are periodic structures which exhibit the appearance of forbidden frequency domain, so called photonic band gaps (PBGs). The PBGs are a range of frequency for which propagation of electromagnetic (EM) waves through PhCs is strictly prohibited. Since the initial predictions of PhCs by Yablonovitch [1] and John [2], the field has attracted the attention of researchers worldwide due to many novel optical applications such as, frequency filters, frequency converters, resonators, sensors, waveguides, optical switches, cavities and design of more efficient layers [3].

The magnetized ferrite photonic crystals (FPhCs) are hot spot in the field of PhCs research, where the PBGs are controlled by the external magnetic field [4-16]. Sigalas et al. [4] analyzed the effect of magnetic permeability on the PBGs theoretically by applying the magnetic field. M. Inoue et al. [5] studied the magneto-optical Faraday effect of one-dimensional (1-D) PhCs composed of Bi-substituted yttrium–iron–garnet (YIG) films and dielectric films such as SiO_2 and TiO_2 films theoretically. S. Linden et al. [6] made 1-D FPhCs that can be applied in the visible light band and obtained the transfer characteristic of the FPhCs by experiment. H. Kato et al. [7] investigated magneto-optical effect in multilayer-structure magnetic films theoretically and analyzed the correlation between the magneto-optical properties and the localization effect of light experimentally.

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