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Contents

Optical properties of 1d metamaterial based photonic crystals with arbitrary changing dielectric and magnetic permittivities

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Reflection and transmission of electromagnetic waves in 1D photonic crystals (PCs) is discussed. The periodicities of both dielectric and magnetic permittivity are taken into account. The theory developed in [1,2] is generalized to solve such problems. The dielectric and magnetic permittivities are considered as spatially changing arbitrary functions. We show for certain, that I a sufficiently large range of cases this problem can be reduced to a set of two linear differential equations instead of the complicated matrix equations of transfer matrix method. The effects of the Photonic Band Gap (PBG) shift, width change, new transmission zone contacts, etc., in cases of different PC apodization and chirp are investigated. This method works very well for standard PCs, as well as for left media and metamaterials. An important consequence is the condition for PBG suppression for all wavelengths, associated with non-constancy of both dielectric and magnetic permittivities. This interesting effect results in complete transmission for a wide range of wavelengths and can find many useful applications in many fields of science and technology, e.g. in light-electricity transformer technique, antireflective coating, solar cells, etc. The light field distribution in the system is investigated, too.

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