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BAND GAPS IN 2D PHOTONIC CRYSTALS WITH HEXAGONAL SYMMETRY

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Rezumat. *Articolul expune, în detaliu, o procedură matematică ce poate fi utilizată la calcularea diagramelor de dispersie corespunzătoare Cristalelor Fotonice bidimensionale cu simetrie hexagonala. În final, sunt date citeva rezultate numerice pentru a dovedi validitatea metodei prezentate.*

Abstract.*The article presents, in detail, a mathematical method useful for calculating dispersion diagrams corresponding to Photonic Crystals with hexagonal symmetry. In the end, a few numerical results are given to confirm the validity of the method.*

Keywords: photonic crystals, hexagonal symmetry, band gaps, plane wave method

1. Introduction

Mathematical calculations and practical experiments show that a composite, formed by a repetitive succession of media with different dielectric permittivities, named also Photonic Crystal, possesses frequency gaps and as a result the electromagnetic fields, with speeds of oscillation inside those gaps, can not propagate through it [1], [2], [3], [4]. Therefore, photonic crystals can be defined as periodical media that have the property of forbidden frequency ranges, a radiation with the wavelength in their frequency gaps being unable to propagate inside these repetitive composites.

The most usual and interesting type of photonic crystal, to date, is a dielectric material characterized by a cyclic electric permittivity that repents in space with a period comparable, as linear dimensions, with the wavelength of the radiation interacting with the dielectric.

No simple formula, able to predict the size and positions of photonic crystals band gaps, exists [5], [6]. Unfortunately, when it comes to establishing the dispersion diagrams of this type of alternating structures, various articles present the results specifying that they have been obtained using a certain numerical method (for instance PWM – Plane Wave Method) implemented with a software conceived by the author, which if available is not well documented and written in a language you are not familiar with. For this reason, programs that calculate the structures of forbidden bands are hard to integrate in your own software, designed to study various properties of photonic crystals, and in conclusion, many people have to write their own piece of code able to calculate the dispersion diagrams, in other

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