UDC 621.396.676 (045)

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2D PHOTONIC CRYSTAL FILTER WITH SQUARE LATTICE

Abstract. *Modified 2D* Π *- structured square lattice photonic crystal adds another bandgap to a standart square lattice narrowband filter.*

3D optoelectronic problems are a hard nut to bite even today. It is very often very difficult to build an appropriate 3D finite elements model (FEM). So, in order to get rid of this "modeling jam", keeping the object's 3D geometry for FEM processing and at the same time being able to overcome those huge (sometimes hundred thousands or even millions elements sized) matrices factorization problems, they propose to use 2D simplified models of 3D genuine material objects.

Physics. The differential equation in partial derivatives for this model is:

$$\nabla \times (\mu_r^{-1} \nabla \times E) - (\varepsilon_r - j\sigma / \omega\varepsilon_0) k_0^2 E = 0,$$

where μ_r - relative magnetic permeability; E - intensity of electric field at the monitoring point, (*V/m*); ε_r - relative dielectric permittivity; σ - conductivity of a proxy element, (*Sm/m*); ω - circular frequency of oscillations, (Rad/s); $\varepsilon_0 = 10^{-9} / 36\pi$ - electric constant, (*F/m*); $k_0 = 2\pi/\lambda$ - wave number; λ - wavelength of oscillations, (*m*).

Results. Above differential equation in partial derivatives for 2D photonic crystal PhC (Fig. 1, a) is solved (Fig. 1, b) by Optiwave FDTD software with help of numerical methods (band gap tolerance 0.025). Input: plane wave, λ=1.5μm . Found 2 band gaps (BG): 0.0462, 0.0865 (Fig. 1, c). Original square lattice gave 0.1178. BG sharpening for the 1-st BG gave 7.16%. 2-nd BG doesn't exist for it.

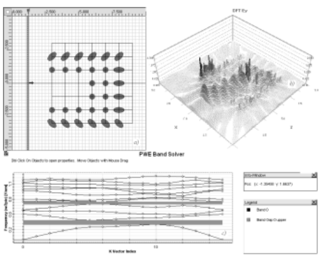

Fig. 1 Radiation patterns of 2D PhC

It was taken as many as 30 round and elliptical pillars ($n_1 = 3.1$ and $n_2 = 1.0$) to build an appropriate FEM. Calculations were done in $\approx$ 19,6 sec. using a modest laptop.