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SUMMARY OF 2D PHOTONIC CRYSTALS

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Photonic crystals (PhCs) are periodic structures with lattice spacing which is big enough to diffract light. Under the right conditions light of certain wavelengths destructively interferes, forming a complete band gap. In this case any incident light of that wavelength completely reflects from the surface [1]. This property of PhCs makes it possible to control the propagation of light. Such photonic devices are used to make waveguides (WGs) with different characteristics - power beam and polarization splitters [2], polarization – maintaining WGs [3], to name a few. PhC logic gates are used to make optical processors [4], which consume exceptionally small amounts of energy. The characteristics of PhCs can be used for broader applications, such as sensing devices [5,6], as well as for more specific fields of interest (to improve the efficiency of thermophotovoltaic solar cells with PhC based absorbers [7]) which shows the potential for many undiscovered implementations. In this paper we summarize the characteristics of lattices in 2D spatial domain. 2D structures are especially common in scientific applications as the 1D lattices PhCs lack a spatial dispersion control and 3D PhCs are harder to fabricate [8]. Plane wave expansion method (PWEM) [9] is used to numerically calculate the band structures of those 2D lattices. In this work we use PWEM numerical algorithm to calculate dispersion properties of such structures. We also demonstrate the effects of spatial dispersion control near the photonic band edge, where light either propagates in such medium through means of self-collimation or negative refraction.

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