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Author Shih-Kun Lin
Author's Email Address No Public.
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Abstract
In this research, we focus on the study of the characteristics and the optimization of the complete bandgap of two-dimensional photonic crystals with square lattice. To analyze the photonic crystal both in frequency and time domains, we first implement the plane-wave expansion method and finite-difference time-domain method and verify their accuracy. Then we study the effect of the structure of the photonic crystal to the computation time and the error of the band structure. Finally we propose a two-stage algorithm to optimize the width of the full bandgap of cousidered photonic crystals. This optimization algorithm uses the plane-wave expansion method to calculate the band structure and uses an iterative method consisting of conjugate gradient method and golden section method to optimize the full bandgap. In addition, we apply the algorithm to various crystal structures with air cylinders. Given that the number of plane waves is 1681, the largest full bandgap we obtained is $\Delta\omega=0.08436(2*pi*c/a)$, where "c" is the speed of the wave in vacuum and "a" is the lattice constant.
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