Analysis of bandgap characteristics of two-dimensional periodic structures by using the source-model technique

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We introduce a solution based on the source-model technique for periodic structures for the problem of electromagnetic scattering by a two-dimensional photonic bandgap crystal slab illuminated by a transverse-magnetic plane wave. The proposed technique takes advantage of the periodicity of the slab by solving the problem within the unit cell of the periodic structure. The results imply the existence of a frequency bandgap and provide a valuable insight into the relationship between the dimensions of a finite periodic structure and its frequency bandgap characteristics. A comparison shows a discrepancy between the frequency bandgap obtained for a very thick slab and the bandgap obtained by solving the corresponding two-dimensionally infinite periodic structure. The final part of the paper is devoted to explaining in detail this apparent discrepancy. © 2003 Optical Society of America

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