
Summary: By adopting the scaling functions of the $B$-spline wavelet on the interval (BSWI) as interpolation functions, a wavelet-based boundary element method (BEM) model is constructed to compute the band structures of two-dimensional photonic crystals (2D PCs), which are composed of square or triangular lattices with arbitrarily shaped inclusions. The boundary integral equations of both the matrix and inclusion are developed in a unit cell because of the structural periodicity. In order to make the curve boundary be compatible well, geometric boundaries are interpolated by employing second order BSWI scaling functions while arbitrary order scaling functions are used to approximate boundary variables. For any given angular frequency, an effective technique is provided to generate matrix values related to the boundary shape. Moreover, singular integral problem involved in the presented wavelet-based BEM is considered. Then, combining the Bloch theorem and the interface conditions, a linear eigenvalue equation related to the Bloch wave vector is obtained. Numerical examples are given to verify the performance of the wavelet-based BEM developed herein compared with the conventional BEM.

MSC:
65-XX Numerical analysis
74-XX Mechanics of deformable solids

Keywords:
photonic crystal; band structure; $B$-spline wavelet on the interval; wavelet-based boundary element method; singular integral

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