SPECTRAL PROPERTIES OF HIGH CONTRAST BAND-GAP MATERIALS AND OPERATORS ON GRAPHS

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ABSTRACT. The theory of classical waves in periodic high contrast photonic and acoustic media leads to the spectral problem $-\Delta u = \lambda \varepsilon u$, where the dielectric constant $\varepsilon(x)$ is a periodic function which assumes a large value ε near a periodic graph Σ in $\mathbb{R}^2$ and is equal to 1 otherwise. Existence and locations of spectral gaps are of primary interest. The high contrast asymptotics naturally leads to pseudodifferential operators of the Dirichlet-to-Neumann type on graphs and on more general structures. Spectra of these operators are studied numerically and analytically. New spectral effects are discovered, among them the "almost discreteness" of the spectrum for a disconnected graph and the existence of "almost localized" waves in some connected purely periodic structures.