Abstract

Optimal Mode Localization in Heterogeneous Media

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One of the fundamental features of photonic bandgap structures is that localized defects in the periodic structure lead to localized states, associated with certain frequencies within the bandgap. These localized states allow the construction of waveguides, laser cavities, and other useful devices. In certain applications such as laser cavities, it is advantageous to obtain highly localized states, since these lead to large energy densities in the gain medium. It is well-known that the spatial energy decay rate of a localized mode depends on the distance of its frequency to the band edge, so that periodic structures with large band gaps tend to yield highly localized modes. Still, such results say nothing about the structure of the defect itself. The basic question addressed in this paper is: "what material distribution within a defect produces 'optimal' energy localization". The problem is formulated as a minimization. Results on well-posedness of the problem, an algorithm for approximating solutions, and preliminary numerical results will be presented.

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