1019-35-50 **Chiu-Yen Kao** (kao@ima.umn.edu), Department of Mathematics, Ohio State University, Math Tower, Columbus, OH 43210, and **Fadil Santosa*** (santosa@math.umn.edu), School of Mathematics, University of Minnesota, Vincent Hall, 206 Church St SE, Minneapolis, MN 55455.
Optimal design of an optical resonator.

We consider resonance phenomena for the scalar wave equation in an inhomogeneous medium. Resonance is a solution to the wave quation which is spatially localized while its time dependence is harmonic except for decay due to radiation. The decay rate, which is inversely proportional to the qualify factor, depends on the material properties of the medium. In this work, the problem of designing a resonator which has high quality factor (low loss) is considered. The design variable is the index of refraction of the medium. High quality resonators are desirable in a variety of applications, including photonic band gap devices.

Finding resonance in a linear wave equation with radiation boundary condition involves solving a nonlinear eigenvalue problem. The magnitude of the ratio between real and imaginary part of the eigenvalue is proportional to the quality factor Q. The optimization we perform is finding a structure which possesses an eigenvalue with largest possible Q. We present a numerical approach for solving this problem. We demonstrate how this approach can be implemented and present numerical examples of high Q structures. (Received August 02, 2006)