



Workshop on Nonlinear Analysis and Control Theory in Honor of Professor Enrique Zuazua for his 60th birthday

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Spectral gaps in planar waveguides.

Rafael Orive-Illera*

Departamento de Matemáticas, Universidad Autónoma de Madrid
Instituto de Ciencias Matemáticas, CSIC-UAM-UCM-UC3M
Madrid, Spain

Abstract

We examine the band-gap structure of the spectrum of the Dirichlet and Neumann problems for the Laplace operator in a strip with periodic dense transversal perforation by identical holes of a small diameter ε . The periodicity cell contains itself a string of holes at a distance $O(\varepsilon)$ between them. Under assumptions on the symmetry of the holes, we derive and justify asymptotic formulas for the endpoints of the spectral bands as $\varepsilon \rightarrow 0$. We demonstrate that, for $\varepsilon > 0$ small enough, some spectral gaps are surely open. The position and size of the opened gaps depend on the boundary conditions, on the strip width, the perforation period, and certain integral characteristics of the holes. We formulate the spectral problem in the periodicity cell via the Floquet–Bloch–Gelfand transform. Because the dependence on the Floquet parameter the analysis of the problem in the periodicity cell requires for a serious modification of the standard justification scheme in homogenization of spectral problems.

Joint work with:

Delfina Gómez¹, Departamento de Matemáticas, Estadística y Computación, Universidad de Cantabria, Santander, Spain.

Sergei A. Nazarov², St. Petersburg State University & Institute of Problems of Mechanical Engineering (RAS), St. Petersburg, Russia.

María-Eugenia Pérez-Martínez³, Departamento de Matemática Aplicada y Ciencias de la Computación, Universidad de Cantabria, Santander, Spain.

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¹E-mail: gomezdel@unican.es

²E-mail: srgnazarov@yahoo.co.uk

³E-mail: meperez@unican.es

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