Thin Waveguides with Robin boundary conditions

G. Bouchitté, Luísa Mascarenhas and L. Trabucho

Faculdade de Ciências e Tecnologia da UNL
Centro de Matemática e Aplicações da UNL

Resumo

We consider the Laplace operator in a thin three dimensional tube with a Robin type condition on its boundary and study, asymptotically, the spectrum of such operator as the diameter of the tube's cross section becomes infinitesimal. In contrast with the Dirichlet condition case studied by us in a previous work, we evidence different behaviors depending on a symmetry criterion for the fundamental mode in the cross section. If that symmetry condition fails, then we prove the localization of lower energy levels in the vicinity of the minimum point of a suitable function on the tube's axis depending on the curvature and the rotation angle. In the symmetric case, the behavior of lower energy modes is shown to be ruled by a one dimensional Sturm-Liouville problem involving an effective potential given in explicit form.