EXPONENTIAL DECAY OF LAPLACIAN EIGENFUNCTIONS IN DOMAINS WITH BRANCHES

B.T. Nguyen

Laboratoire de Physique de la Matière Condensée (UMR 7643), CNRS - Ecole Polytechnique

We present the behavior of Laplacian eigenfunctions in domains with branches of variable cross-sectional profile. Using the Maslov-type differential inequalities, we prove that if an eigenvalue is below a threshold which is determined by the shape of the branch, the corresponding eigenfunction exponentially decays inside this branch. The decay rate is twice the square root of the difference between the threshold and the eigenvalue. The derived exponential estimate can be applicable for arbitrary domains in any spatial dimension while branches are assumed to be simply-connected and to have smooth boundaries. Numerical simulations illustrate the theoretical estimate and indicate that the above conditions on the branch shapes could be relaxed. This theorem significantly extends the classical results for waveguides of constant cross-sectional profile.