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Eigenvalues and eigenfunctions for the Laplace Operator

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Abstract

The eigenvalues of the Laplace operator for the Dirichlet, Neumann and Robin problems in the interior of an equilateral triangle were first obtained by Lamé. Here, we present a simple, unified approach for deriving the relevant eigenvalues for several types of Boundary Value Problems (BVPs). Among these results the most general one consists of a system of explicit algebraic equations which give the eigenvalues for the Poincaré type BVP. These formulae for the Poincaré eigenvalues yield, via appropriate limits, the relevant formulae for the oblique Robin, Robin, Neumann and Dirichlet eigenvalues. The latter three give exactly the above mentioned results of Lamé. The method introduced here is based on the analysis of the so-called global relation, which as shown recently in the literature provides an effective tool for the study of BVPs. Moreover, we illustrate results considering the relevant eigenfunctions and some ideas related to other convex and bounded regular domains

Key words: Eigenvalues, Laplace operator, global relation.