Curriculum Vitae

Ling-Huang Yu

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1 Education:

Ph.D. Applied Mathematics,
Michigan State University, May 2001.
Thesis Title: The Lowest Eigenvalue of the Negative Laplacian in two Dimensions — A Modified Perturbation Method

M.A. Mathematics,
Michigan State University, May 1993.

B.S. Mathematics,
Tunghai University, Taiwan, June 1990.

2 Professional Experience:

Visiting Assistant Professor National Chung Cheng University, 2001 – 2002

taught— Perturbation Methods (graduate level, Fall 01 and Spring 02)
Linear Algebra (Fall 01)
Calculus (Spring 02)

Teaching Assistant Michigan State University, 1995 – 2001
taught— Intermediate Algebra, College Algebra, College Algebra and Trigonometry, Survey of Calculus with Applications.
recitation— Calculus

Instructor Tunghai University, Taiwan, 1993 –1994
taught— Calculus, Foundations of Mathematics, Topology.

Teaching Assistant Tunghai University, Taiwan, 1990 –1991
recitation— Calculus, Advanced Calculus, Real Analysis.

3 Research Interest:

- Applied Mathematics
- Perturbation Methods
- Vibration of Membranes

4 Grant:

- NSC 90-2115-M-194-030 *" Approximations of the Lowest Eigenvalues of the Negative Laplacian in two Dimensions "*.

5 Publication:

- L. H. Yu and C. Y. Wang, "Fundamental Frequencies of a Circular Membrane With a Centered Strip", *J. Sound. Vib.*(SCI), **239(2)**, 363-368 (2001)

  abstract The first three order terms of the asymptotic expansion formula ($c \to 0$) to the fundamental frequency K of a circular membrane with a centered strip of length $2c$ are computed numerically by applying the domain decomposition and eigenfunction matching method. Guided by our analysis to an elliptic membrane of area π with an internal confocal strip of length $2c$ and a least squares fit on our numerical results, the asymptotic expansion formula is $K = K_0 + \frac{K_1}{|\ln c|} + \frac{K_2}{|\ln c|^2} + \cdots$, $c \to 0$ where $K_0 = 2.4048$, $K_1 = 1.55$, $K_2 = -0.012$.

details See attachment.

- L. H. Yu, "Fundamental Frequency of a Doubly Connected Membrane: a Modified Perturbation Method", submitted to *IMA Journal of Applied Mathematics*, (2001)

  abstract The fundamental frequency of a membrane is the square root of the lowest eigenvalue of the negative Laplace operator with Dirichlet boundary conditions. A doubly connected membrane with the inner region of vanishing maximal dimension $2c$ is considered in the present article. A modified perturbation method is developed to provide an asymptotic expansion ($c \to 0$) for the fundamental frequency of the membrane. The first three order terms of the asymptotic expansion for the fundamental frequency of a doubly connected membrane with the circular inner region are derived explicitly. The results are compared with the exact solutions and the approximations determined by other investigators. The error of the perturbation calculations compared with the exact values is less than 1% as c is less than 0.25 and is less than 4% as c is less than 0.35.

6 Thesis Description:

description A modified perturbation method is developed to provide the asymptotic expansion formula to the smallest eigenvalue of the negative Laplacian in a bounded doubly connected region in two dimension with the inner boundary enclosing a region of a small maximum dimension $2c$, $c \ll 1$. The method is formulated by applying perturbation technique, reflection method, and the Fredholm Alternative theorem. The first three order terms of the asymptotic expansion formula are carried out explicitly by correcting the inner and outer boundary conditions alternatively and by applying the generalized Green's functions.

The main contribution of the thesis is two-fold. First, from the computationl point of view, a general formula to the asymptotic expansion of the smallest eigenvalue of the negative Laplacian in the doubly connected region is formed, moreover, the first three order terms of the formula are computed explicitly. Second, from the point of view of the inverse problem, relations between the first three order terms of the formula and geometric properties of the region are investigated from the computed formula, the shape of the inner boundary starts to affect the formula at the 2^{nd} order term while the position of the inner boundary starting to affect the formula at the 1^{st} order term and the shape of the outer boundary starting to affect the formula at the $zero^{th}$ order term.

The results are useful in the determination of the fundamental frequency of vibrating membranes and in that of the cut-off frequency of electromagnetic waveguides.

details Thesis manuscript copy supplied upon request.