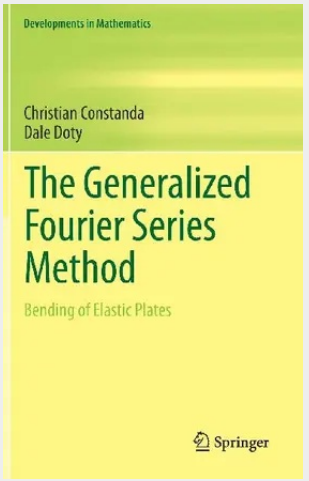
Constanda / Doty

The Generalized Fourier Series Method

Bending of Elastic Plates



This book explains in detail the generalized Fourier series technique for the approximate solution of a mathematical model governed by a linear elliptic partial differential equation or system with constant coefficients. The power, sophistication, and adaptability of the method are illustrated in application to the theory of plates with transverse shear deformation, chosen because of its complexity and special features. In a clear and accessible style, the authors show how the building blocks of the method are developed, and comment on the advantages of this procedure over other numerical approaches. An extensive discussion of the computational algorithms is presented, which encompasses their structure, operation, and accuracy in relation to several appropriately selected examples of classical boundary value problems in both finite and infinite domains. The systematic description of the technique, complemented by explanations of the use of the underlying software, will help the readers create their own codes to find approximate solutions to other similar models. The work is aimed at a diverse readership, including advanced undergraduates, graduate students, general scientific researchers, and engineers.

The book strikes a good balance between the theoretical results and the use of appropriate numerical applications. The first chapter gives a detailed presentation of the differential equations of the mathematical model, and of the associated boundary value problems with Dirichlet, Neumann, and Robin conditions. The second chapter presents the fundamentals of generalized Fourier series, and some appropriate techniques for orthonormalizing a complete set of functions in a Hilbert space. Each of the remaining six chapters deals with one of the combinations of domain-type (interior or exterior) and nature of the prescribed conditions on the boundary. The appendices are designed to give insight into some of the computational issues that arise from the use of the numerical methods described in the book.

Readers may also want to reference the authors' other books *Mathematical Methods for Elastic Plates* , ISBN: 978-1-4471-6433-3 and *Boundary Integral Equation Methods and Numerical Solutions: Thin Plates on an Elastic Foundation* , ISBN: 978-3-319-26307-6.

The book presents and explains a general, efficient, and elegant method of approximate solution for boundary value problems for an elliptic system of partial differential equations arising in elasticity theory. The methodology for constructing generalized Fourier series based on the structure of the problem is shown in detail, and all the attending mathematical properties are derived with full rigor. A numerical scheme directly related to the series method is developed and employed to compute approximate solutions, illustrated by a variety of examples.

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