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Journal of Sound and Vibration 278 (2004) 1215–1216
JOURNAL OF SOUND AND VIBRATION
www.elsevier.com/locate/jsvi

Book review

M.S. Qatu, Vibration of Laminated Shells and Plates, Elsevier, Amsterdam, ISBN 0-08-044271-4, 2004 (pp. xvi + 409, price €180, US$180).

There are several books on laminated plates and shells, some of which contain a single chapter on vibration analysis. The present book is the first, as far as this reviewer is aware, totally devoted to vibration of such structures. According to the Preface, the book documents some of the latest research in the field and fills certain gaps.

The first chapter begins with a brief history of the development of the theory of homogeneous and laminated plates and shells and an overview of the contents of the book. This is followed by a summary of the equations of elasticity in rectangular coordinates and concludes with a section on energy expressions and variational principles.

The second chapter reviews the various theories used for analysing composite shells. The equations are written in curvilinear coordinates so that they can easily be specialized for beams, plates and different shell geometries. Both thick and thin shell theories are treated. A full derivation of the equations of motion is not given, but numerous references are given where these details can be found. Nonlinear and layerwise theories, which are not covered in the book, are briefly discussed. The chapter ends with a summary of the number of equations and unknowns for each of the theories presented.

Chapter three begins with a brief survey of experimental methods, exact and approximate solutions for investigating the vibration characteristics of laminated composites. Sections that describe the Ritz, Galerkin and finite element methods follow this. The chapter ends with a brief survey of other techniques.

Chapter four is about the vibration of curved beams vibrating in their plane of curvature. The fundamental equations for thick and thin laminated beams are first derived. Exact and approximate solutions (using the Ritz method) are obtained for various configurations.

In the fifth chapter, the previously derived equations for shells are specialized to those for plates by setting the curvatures to zero. Both thin and moderately thick plates are treated. Solutions are then obtained for the vibration of rectangular, triangular, trapezoidal and circular plates. A number of laminate configurations where exact solutions are possible are considered. In other cases the Ritz method is utilized. Both natural frequencies and mode shapes are presented.

Chapter six deals with doubly curved shallow shells and begins with a derivation of the fundamental equations. Like the previous chapter, exact and approximate solutions using the Ritz method are obtained for various planforms and laminate configurations.

doi:10.1016/j.jsv.2004.07.005

Cylindrical shells are the subject of Chapter seven. Results are presented for open and closed cylindrical shells having a circular cross-section. There is also a section on barrel shells. Finally, closed cylindrical shells with non-circular cross-sections are treated.

Conical and spherical shells are the subjects of Chapters eight and nine. After deriving the fundamental equations, results are presented for selected configurations. Both chapters end with a section on recent developments.

The final chapter reviews the literature concerned with complicating effects that include dynamic loading, thermal stresses, rotating, stiffened, imperfect, piezoelectric, damped and viscoelastic shells. There is also a section on shells imbedded in (or filled with) elastic or fluid media.

The book concludes with four appendices containing tables of natural frequencies and an extensive list of references for further reading.

The book will prove to be extremely useful to researchers and others interested in the vibration of laminated structures. However, some prior knowledge of vibration, elasticity, variational methods and the theory of plates, shells and composite structures would be beneficial before reading the book. The author is to be congratulated on presenting a complicated topic in such a clear manner.

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