Book Review

Vibrations of Shells and Plates, by Werner Soedel. Published by Marcel Dekker, Inc., New York, 1981. $135.00, 470 pp.

This is a revised and enlarged second edition that contains new chapters on recent developments in shells and plates. Some topics are more detailed than in the first edition. Although it does not contain exercise problems, the book is intended for graduate students. It is also useful for practicing engineers and researchers involved in theoretical and even experimental work because it provides insight into problems faced during experimentation.

This book contains 21 chapters and starts with the historical development of vibrations of continuous systems in **Chapter 1. Chapter 2** is the most important chapter as it contains the detailed derivation of Love's equations for the deep shell, where shell thickness is small compared to the shell curvature and shell deflection is small. This chapter also contains topics on Hamilton's principle, boundary conditions, and explains the differences between the different deep shell theories, giving the required modifications. Modifications required to accommodate the shell of nonuniform thickness are also given. In **Chapter 3** modifications and simplifications required to obtain equations of shell-of-revolution, circular, conical, cylindrical, and spherical shells from Love's equations are identified and corresponding expressions are presented. Equations of non-shell structures such as an arch, beam, rod, circular ring, and plate are derived directly from the Love's equations in **Chapter 4.** The basic approach of finding natural frequencies and mode shapes is presented in **Chapter 5.** Also, closed form expressions to calculate natural frequencies and corresponding mode shapes are given for transversely vibrating beams, circular ring, rectangular, and circular plate. Lastly, mode superposition approach is presented. **Chapter 6** contains simplified shell equations based on membrane approximation, bending approximation, etc., and practical applications to fan blade and to different shell shapes are presented.

In **Chapter 7** the use of well known approximate approaches, such as Galerkin's, Rayleigh–Ritz, Southwell's, and Dunkerley's, to the shell structures are presented. The mode summation approach to study forced vibrations of shells is presented in **Chapter 8.** Chapter 8 also presents the approaches to account for a suddenly applied load, point, and a line load. A Green's function approach is presented in **Chapter 9** and Green's functions for simply supported shell, a closed circular ring, and a simply supported cylindrical shell are presented. A case of load traveling around the cylindrical shell is also presented. The approach to treat moment loading, the effect of initial stresses, shear deformation, and rotary inertia on shells are presented in **Chapters 10–12,** respectively.

Most of the real structures are combinations of different elements such as plates, shells springs, stiffeners, and/or elastically supported mass, etc. A receptance method to solve for natural frequencies and mode shapes of these combined shell structures is presented in **Chapter 13.** The effect of hysteresis damping is considered in **Chapter 14** and a modal expansion approach is presented to study the forced vibration of shells. The use of composite materials is expanding rapidly and the basic stress strain relations are de-

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tailed in the first part of **Chapter 15** followed by examples of orthotropic plate, circular cylindrical shell, textile nets, and curtain. The effect of rotation on vibration of string, beam, ring, and cylindrical shells is presented in **Chapter 16.** The effect of thermal stresses and elastic foundations are considered in **Chapters 17** and **18,** respectively. The approach to use nondimensional analysis in the investigation of shell and plate vibrations is presented in **Chapter 19.** The effects of surrounding gases and liquids on vibrating structures are considered in **Chapter 20,** where basic equations are given in the first part followed by wave equations for solids, interface boundary conditions, and an example of a plate vibrating with liquid on the top of the plate. These chapters are very useful to the practicing engineer, as real problems often involve these complicated effects. **Chapter 21** gives a brief introduction to the widely used approximate numerical approach based on the finite element and finite difference methods.

The book is well written and contains detailed derivations of most important equations. The necessary details to modify Love's equations of thin shell to other structures are given. Additional references are given after every chapter. This book is an excellent reference in the field of shell and plate vibrations and contains many modern developments in this field. I suggest that every technical library should have a copy of this book.

Reviewed by:
Dr. C. N. Bapat
Associate Professor of Mechanical Engineering
City College of the City University
of New York
New York, NY