Book Review

Vibrations of Shells and Plates, by Werner Soedel,
Marcel Dekker, Inc., New York and Basel, 1981, xiv + 366 pp., $59.75.

With the continuing, in fact increasing, importance of dynamic loading of shell and plate structures in aerospace systems, there has been an urgent need for a textbook which treats this important topic. The monographs by Professor Leissa (NASA SP-160 and SP-288) have provided detailed compendia of solution characteristics, and the text by H. Kraus (*Thin Elastic Shells*, Wiley, 1967, now out of print) included three chapters on shell dynamics. Nevertheless, until the appearance of the present book by Professor Soedel, there has been no complete textbook presentation of the vibrations of shells and plates.

Chapter 1 gives a fascinating presentation of the historical development of the subject of vibration analysis of structures, starting with the treatment of a pendulum by Galileo (1564-1642). It clearly describes the contributions of such giants as Newton, the Bernoullis, Germaine, Lagrange, Poisson, Kirchhoff, Rayleigh, and Love.

In Chapter 2, the basic governing equations of motion and boundary conditions are derived for isotropic thin shells in orthogonal curvilinear coordinates. In the next two chapters, these equations are reduced to various special cases: shells of revolution, circular conical and cylindrical shells, spherical shells, curved beams, rings, and plates. Chapter 5 presents solutions, starting with beams for clarity, then moving on to rings, rectangular and circular plates, and circular cylindrical shells.

In Chapter 6 are presented various simplifications of the general theory: the membrane and inextensional approximations, and shallow shell theory. Chapter 7 discusses briefly a variety of approximate solution techniques: the variational approach, the Galerkin and Rayleigh-Ritz methods, finite differences, and the increasingly popular finite element method.

The forced behavior of shells and plates is discussed in Chapters 8-10. Topics include the modal analysis approach for distributed loadings, the Dirac delta function for point and line loads, and the Green's function approach for traveling loads.

Chapter 11 treats the effect of initial-stress fields, so important for vibrations of pressurized structures. In Chapter 12, the effects of transverse shear deformation and rotatory inertia, so important for thick shells, are added. Unfortunately, here the author misses an opportunity to introduce sandwich-type structures. Combinations of structures, such as discretely stiffened plates and shells with dynamic absorbers, are described in Chapter 13. Chapter 14 is a concise treatment of hysteretic damping.

The last chapter is a concise treatment of laminated composite-material structures, with specific reductions to orthotropic rectangular plates and circular cylindrical shells. Unfortunately, more general lamination schemes, such as angle-ply layups, are not specifically discussed.

Overall, this book is very clearly written, well illustrated, and nearly free of printing errors. For those wishing to dig deeper into specialized aspects, a modest bibliography appears at the end of each chapter. For use as a text, its only significant lack is that it does not give any problem sets (exercises). This book fills the gap between elementary and intermediate vibration texts and the vast literature of shell and plate dynamics. Thus, it should prove to be an excellent text for a graduate course, as well as an introductory guide to young structural dynamicists entering into the challenging field of plate and shell dynamics.

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