Structural Acoustics: Deterministic and Random Phenomena

Joshua E. Greenspon, CRC Press/Taylor and Francis Group, Boca Raton, (2011), 281 pp., hardbound, 139.95 USD, ISBN 978-1-4398-3093-2

This book is the culmination of a long-term research program in the field of structural acoustics undertaken by one of the most distinguished pioneers in this field. Greenspon's publications in the form of papers and reports are the basis for the major part of this book.

Structural Acoustics is in two sections. The first section, eight-chapter long, is devoted to deterministic phenomena. The second section, six-chapter long, is on random phenomena.

Section One's first three chapters cover fundamentals of linear acoustics and structural vibrations. Chapter 1 is introductory and Chapters 2 and 3 cover the classical treatment of wave propagation in acoustic media. Chapter 4 covers the vibration of rods and beams, including Timoshenko beam theory of shear deformation and rotatory inertias, and beams with non-uniform cross-sections. This chapter includes a computer code for solving beam vibration problems of the types of beams discussed in this chapter.

Chapter 5 covers the derivation of equations of motion of unstiffened plates; both the classical Kirchoff plate theory and the Timoshenko–Mindlin plate deformation theory, which includes shear deformation and rotatory inertias. This chapter also gives a detailed treatment of rib-stiffened plates, sandwich plates, and composite orthotropic plates. Chapter 6 considers structures built up from plates to model three-dimensional shells. The formulation, by necessity, includes bending, twisting, stretching, and shearing in order to mimic a representation of three-dimensional shell structures. The formulation is based on potential energy, culminating in complete set of expressions for the stiffness matrices of the built-up structure. Chapter 7 gives an exhaustive coverage of cylindrical shells' dynamics: isotropic, orthotropic, reinforced, and sandwich shell constructions. The chapter also covers fluid–structure interaction. The solution for modal and forced response is presented in detail with a computer code that covers the most general case. However, the chapter fails to cover other shell structures, such as spherical, spheroidal, and shallow shells. Chapter 8 has a minimal coverage of elasticity theory's role in structural dynamics.

Section Two starts with Chapter 9 that treats the basics of random excitation of linear dynamical systems. Chapter 10 covers statistical acoustics formulated with Green's functions approach. Chapter 11 deals with the dynamical response of structures excited by random forces. This chapter is based on modal structural response and the resulting acoustic radiation. Chapter 12 concentrates on an application of Chapter 10 to the problems of random excitation of cylindrical shell structures based on modal approach. The chapter also includes a fairly general and complete computer code for the dynamic response and the acoustic radiation from the cylindrical shells of the types that were formulated in Chapter 7. An application to turbulence excitation is presented. Finally, Chapter 13 deals with relationship of nearfield acoustic measurements to the prediction of farfield acoustic radiation and its application to acoustical and structural scale models. There is an index.

The book is a valuable addition to the meager number of books in structural acoustics. It complements Junger and Feit's book *Sound structures and their Interactions.* The book is targeted equally to graduate students and acoustical researchers.

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