

Book Review

Review of The Theory and Practice of Hydrodynamics and Vibration by Subrata Chakrabarti, published by World Scientific (2002) as Volume 20 in their Advanced Series on Ocean Engineering, prepared by Daniel T. Valentine, Clarkson University.

This book is straightforward and enjoyable to read. It presents a review of hydrodynamics and vibration, and an investigation of engineering analysis methods used in design decision-making. The methods described are for the examination of fluid-structure interaction phenomena and how they relate to engineering decisions. The author states in the Preface that it is a textbook intended to be “used as a teaching guide” for advanced-level undergraduates. At the beginning of the last chapter on Case Studies, the author provides an overview of the material presented. He states the following:

“The examples are chosen to include structures experiencing vibration in steady fluid flow as well as in waves in the ocean, and include full-scale experience as well as model experiments in a controlled environment. It is noted that the design of these structures often uses simple calculations without resorting to complicated analysis. This is particularly true in the initial phases of design. In many cases, simplified theory is used, recognizing that the methodology may not be mathematically consistent and correct, but the results are of practical importance. The examples demonstrate how some of the experienced-based, overly simplified analyses may be able to explain the physical phenomenon, and provide reasonable results suitable for design and analysis of the system under consideration.”

It is in the last chapter that the practical applications of the theory outlined in the first eight chapters are illustrated. There are chapters on hydrodynamics, vibration, experiments in hydrodynamics and vibration, statistical theory and random vibrations,

fluid-structure interaction, and fluid-induced vibration via vortex shedding. Models for linear and nonlinear vibrations are introduced and applied. This book shows how an engineer can apply the tools learned as an undergraduate in first courses on hydrodynamics and on vibrations to examine practical problems in offshore engineering. Thus, it is a useful text for a course in which the practical application of tools learned in other courses in an engineering curriculum is investigated. It is also useful for a first course on fluid-structure interaction.

How is this a useful textbook? It is useful for an instructor who needs a book that provides a reasonably good overview of the fundamentals of engineering science and a discussion on how the fundamentals are applied to solve practical problems. The instructor has many opportunities to clarify and expand on what is presented. Although there are a handful of typographical errors, they are obvious and, hence, easily corrected. Sometimes nonviscous and viscous flow phenomena are discussed in such a way that they are not always segregated appropriately for this reader’s taste. For example, when the analysis of vortex-induced vibration (VIV) is discussed, the vorticity-transport equation for a nonviscous flow is presented without emphasizing that the viscous diffusion term was neglected. This equation is immediately followed by the “Navier-Stokes equation” in two dimensions, the set of which is for a Newtonian-viscous fluid. These are instances where the instructor has an opportunity to play the role of facilitator of discussions to clarify the material presented in the text by recalling the student’s background from the prerequisite first courses in fluid mechanics and dynamics. Since, Dr. Subrata Chakrabarti is a well-known expert in offshore engineering, it is not surprising that this book is filled with numerous practical insights in the area of fluid-structure interaction.