BOOK REVIEW / CRITIQUE DE LIVRE

Dynamic stability of structures. By Wei-Chau Xie. Cambridge University Press, 40 West 20th Street, New York, NY 10013-2473, USA. 2006. Hardcover; 435 pp. US$125.00. ISBN-13: 978-0-521-85266-1. ISBN-10: 0-521-85266-8. doi: 10.2277/0521852668.

This book is a thorough and scholarly presentation of a topic that is not easy, but is very important in structural mechanics: the stability of structural systems under dynamic excitation, either deterministic or stochastic. For those interested in dynamics problems or nonlinear mechanics, this is a beautiful topic on its own. However, it is also a very important topic from a practical point of view, as it studies the conditions under which the behavior of a mechanical system could drastically change, either for a range of the parameters appearing in the governing equations of motion (parametric resonance) or for some characteristics of the forcing functions (ordinary resonance). In either case, such a study must involve consideration of nonlinear effects in the governing equations and this, in turn, contributes to the difficulty of approaching this topic, as it involves advanced mathematical tools and concepts.

The book is very well written and edited, introducing the dynamic concepts and mathematical tools at a reasonable, slow rate, with good motivational illustrating examples. The topics are presented in two main parts, each with several chapters. In Part I, the dynamic stability of systems is studied under deterministic forcing functions; in Part II, the problems consider the presence of random or stochastic excitations. Thus, the treatment is thorough and complete, and either part can stand on its own. Part II contains a very good introduction to probabilistic concepts, stochastic processes, and their statistical representation. In particular, Part II makes an excellent presentation of specific random processes and their characteristics (Gaussian, Wiener, Markov, diffusion processes, and the Fokker–Planck equation). This reviewer particularly enjoyed this section of the book. It also contains a unique and clear discussion of Lyapunov exponents and moment Lyapunov exponents and their use in the characterization of instability regions. This discussion includes most of the work by the author in this area, including his recent contribution on the application of Monte Carlo simulation for moment Lyapunov exponents.

At the end, the book also incorporates several relevant algorithms programmed in *Maple* (a package for symbolic computation), which should be of use to interested readers. The author, however, makes the refreshing argument that these programs should not replace "learning and thinking," and that they are only included for a balance in the presentation.

Overall, the book is of very high scientific quality, with thorough references to previous work, results by the many prominent researchers in this field, and, of course, includes the original previous work by the author. The book is an excellent textbook for an advanced level graduate course, and calls for slow and meditative reading. In the end, however, the reader will have the feeling of having been walked, in a methodical and scientific way, through a fascinating area of dynamics. For practitioners who may be involved in the consideration of dynamic instability problems, this book should be a required component of their reference shelf.

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