

A Review of “Engineering Dynamics and Vibrations: Recent Developments”

Junbo Jia and Jeom Kee Paik, Editors
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The “Engineering Dynamics and Vibrations” book is intended for audiences with a background in marine and civil engineering structures. It is an edited volume (with 10 self-contained chapters) and thus it may be used by both researchers and graduate students since the editors address “engineering failures due to inappropriate accounting of dynamics to mitigation measures and utilization of dynamics.” However, a vast majority of practicing noise and vibration engineers and scientists (the readers of NCEJ of course) would find it rather difficult to navigate their way through the contents even though the book claims to cover “a wide range of topics from the basics to advances in dynamics and vibrations.” It is available via amazon.com and perhaps other sites.

After a brief preface and a forward, one of the editors (Jia) provides a meaningful introduction (in Chapter 1 — Introduction to Dynamics, Vibrations and Impacts) that gives the reader an overview of the contents of the book as well as some practical significance along with a short historical perspective. The subject matter of Chapter 2 (Nonlinear Structural Responses Associated with Hydrocarbon Explosions by Paik et al.) is motivated by accidents and fires on offshore oil and gas platforms, and a nonlinear analysis with illustrative examples is presented. Perhaps of more importance is a description of the recommended practices and engineering methods along with suggestions for further investigations. A comprehensive treatment of the stochastic methods is covered in Chapter 3 (Stochastic Dynamic Analysis of Marine Structures by Leira and Chai). Both linear and nonlinear structural analyses are covered along with reliability theory, failure analysis, industrial practice, design rules and the like. This chapter is indeed the heart of this book, and the authors clearly identify the mathematical symbols and equations and then end the chapter with an extensive list of references for the benefit of future researchers. Chapter 4 (Mitigation of Stresses and Vibrations in Deep-water Steel Riser Design by Introducing a Lazy Wave Geometry by Felisita et al.) addresses the analysis and design of floating platforms, semisubmersibles and other undersea structures. Design guidelines to mitigate stresses and vibration-induced fatigue are covered in a non-mathematical manner. The subsequent chapter (5 — Wind Induced Dynamic Response Calculations by Strommen) is quite mathematical, but key assumptions and simplified mode calculations of the vibratory responses are well described. The author describes some of the calculation difficulties in the concluding remarks section while suggesting future experimental studies.

Chapter 6 (Neo-Deterministic Scenario-Earthquake Accelerograms and Spectra: a NDSHA Approach to Seismic Analysis by Rugarli et al.) provides an overview of earthquake-driven risks. The fundamental theory of the neo-deterministic seismic hazard assessment (NDSHA) is explained, and illustrative examples from Italy etc. are provided; the reference list is rather long but quite useful for seismic type analysis. The next chapter (7 — Ground Motion Prediction Equations for Energy-Based Demand Parameters: Regional Application to Northwestern Turkey by Saria and Manuel) describes an energy-based technique and compares it with peak acceleration type (or the so-called strength-based) parameters. The seismic analysis continues in Chapter 8 (Nonlinear Seismic Analysis of Framed Structures by Antoniou and Pinho). Typical sources of nonlinear structural elements are described along with selected nonlinear solution methods, followed by sample results including some comparison with experiments on framed structures. In a similar manner, Chapter 9 (Seismic Mitigation of Single Pylon Cable-Stayed Bridge by Han et al.) presents nonlinear models and seismic mitigation control devices such as viscous dampers with application to cable bridges. Finally, the last chapter (10 — Principles of Noise Control by Thompson) addresses the basic elements of source-path-receiver paradigm; the readers of NCEJ should be well familiar with the classical noise control techniques.

Personally, I have found this book interesting as it reinforces the concepts and applications of nonlinear dynamics and random vibration with application to structural, marine and mechanical systems. Students and researchers interested in analytical, computational and experimental aspects of seismic analysis, structural health monitoring and related subjects will find this book to be a valuable resource. Some deficiencies that I see from the perspective of readers and potential users (and perhaps more from the viewpoint of a teacher of graduate level and engineering practice type courses) are as follows. I found the title to be very broad since it addresses only a subset of dynamic and vibration problems. Abbreviations in some chapters such as DAF, VIV, AD and so on are distracting. The treatment of this multi-authored book is quite heterogeneous as each chapter is unique (or independent) and there are no connections made to the material presented elsewhere in the book. Users might have been interested in sample finite element or simple lumped system dynamics codes based on the techniques presented here, but these are nowhere mentioned or placed on a website. No practice questions or exercises at the end of each chapter are given and thus it would be impossible to use it as a textbook. Nevertheless, it is a useful reference book for serious structural analysts.

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