Preface

This book provides the fruits of a team effort by international experts in the field of engineering dynamics, vibrations, and impacts. It contains both essential basics and new developments in this area.

The subject of dynamics and vibrations originated from Sir Isaac Newton's monograph *Philosophiæ Naturalis Principia Mathematica*, and Lord Rayleigh paved the way for its further development with his *Theory of Sound*. These provided the basis for the unique position of the field of dynamics in mechanics. Since then, many scientists and engineers have applied and furthered this knowledge in various fields of applied science and technology.

With the enormous investment made in civil, mechanical and aerospace engineering during the 20^{th} century, designs were pushed to the limits of their performance capacity, with the trend being toward high-speed operations, adverse environment capability, light weight etc. With the requirement of functionality in an unpredictable, highly uncertain environment, practicing engineers encountered more and more problems with regard to dynamics. Although dynamics as a scientific topic is by no means fully understood (and perhaps never will be), the great amount of activity in this field during the last century has made it possible to form a practical subject in a fairly systematic, coherent, and quantitative manner. All these factors have pushed applied dynamics into a greater complexity than it has ever had before, and also promoted the subject into one of the essential tools in current engineering.

Thanks to the rapid development of computer technology, more portable and accurate testing equipment and techniques, as well as a few breakthroughs in computation algorithms, during the last 50 years applied dynamics has found efficient and unique ways of developing. This raised a vast amount of challenges in implementing designs in reality, while also putting ever higher demands on engineers, requiring a thorough understanding of the subject. In spite of increased engineering knowledge, the practical problems regarding dynamics and vibrations are in some cases handled without success despite large expenditures of money. Moreover, even if engineers can perform sophisticated computer-based dynamic analysis tasks, many of them lack an actual understanding of the essential principles of dynamics, and hence of the links between theory and application. This leads to an insurmountable barrier when they are requested to validate/verify and provide insightful explanations of analysis results, or to further improve the engineering designs with regard to dynamics, vibrations, and impacts, which poses a significant safety hazard and can also result in significant economic loss.

With the objective of providing principles and up-to-date knowledge of engineering dynamics, vibrations, and impacts for solving practical and challenging engineering problems, this edited volume covers topics on the concepts, principles and solutions in this area. The book aims to be as elegant as is possible given this wide-ranging treatment of the subject. It contains knowledges from essentials on dynamics, vibrations, and impacts to more advanced topics on nonlinear dynamics, stochastic dynamics, from basic principles to its applications associated with various dynamic actions due to wind, ocean wave, earthquake, and explosion loadings. As a particular topic on dynamics, a special chapter is dedicated to elaborate the principles of noise control.

The book is intended to serve as an introduction to the subject and also as a reference book with advanced topics. A balance between the theoretical and practical aspects is sought. All

the chapters are addressed to practicing engineers who are looking for answers to their daily engineering problems, and to students and researchers who are looking for links between theoretical and practical aspects. It should also be of use to other science and engineering professionals and students with an interest in general dynamics, vibrations, and acoustics. Ultimately, the book should be useful for designing tolerant structural systems against extreme and accidental conditions.

While the book does not seek to promote any specific "school of thoughts," it inevitably reflects chapter authors' "best practice" and "working habit." This is particularly apparent in the topics selected and level of detail devoted to each of them, their sequences, and the choices of many mathematical treatments and symbol notations etc. The editors hope that this does not deter the readers from seeking to find their own "best practice".

We are indebted to many individuals and organizations for assistance of various kinds, such as participation in book reviews and copyright clearance. Moreover, this book has an extensive list of references reflecting both the historical and recent developments of the subject. We would like to thank all the authors in the book references for their contribution to the area.

This edited volume will be updated periodically to reflect the latest developments in this area, and also be expanded to include more topics with chapters in a handbook style.

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