Preface

In this short book, Classical Modal Analysis (CMA) is first reviewed for application to structural and acoustical, e.g., plates and acoustic cavities, as well as dynamical systems that can be considered as comprising interconnected components, e.g., interconnected plates. Also treated are combined structural and acoustical systems. Ultimately, at higher frequencies, we consider Asymptotic Modal Analysis (AMA) as the asymptotic limit of CMA when a large number of resonant modes are excited in a frequency bandwidth, and we illustrate the challenges and opportunities that analyzing this type of system presents to the analyst and engineer.

The topics covered are shown in the Table of Contents, and it is believed that the book will be useful to a range of readers including those encountering theoretical modal analysis for the first time, as well as those who have been using modal analysis for many years and are interested in the recent developments, particularly at higher frequencies. An experienced reader may use the initial CMA chapter as a review and reference source, but we hope each chapter is sufficiently self-contained that a reader may begin the reading of the book at almost any Chapter of special interest.

A word is appropriate about the relationship of modal analysis to Finite Element Analysis (FEA) and Statistical Energy Analysis (SEA). As many readers will know, SEA (and subsequently AMA) was developed in significant part because of the difficulty of using FEA when a large number of modes are needed to describe the dynamics of a system. Yet, one of the great virtues of FEA is that it allows one to determine the modes of complex systems which are beyond the reach of classical eigenvalue/eigenfunction analysis for simpler geometries. But one may most usefully think of FEA, SEA, and indeed AMA as complementary approaches. And, indeed, when using FEA, one may wish to consider whether the system dynamics have effectively entered the domain of SEA and/or AMA. Thus, a knowledge and understanding of AMA and SEA will help the FEA analyst as well.

Finally, as will be evident from the chapter references, the use of CMA, its extension to higher frequency ranges, and ultimately to AMA, has been a research effort of the authors that has also stimulated them to think harder and more deeply about these fascinating topics. We hope that the reader will share this deep interest which has led the present authors to compile this book that summarize the extension of CMA capabilities for higher frequency applications.

Shung H. Sung, Dean R. Culver, Donald J. Nefske, and Earl H. Dowell
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