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0521017661 - Statistical Energy Analysis: An Overview, with Applications in Structural Dynamics

A. J. Keane and W. G. Price

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This volume provides an up-to-date overview of statistical energy analysis and its applications in structural vibration.

Statistical energy analysis (SEA) is a powerful method for predicting and analysing the vibrational behaviour of structures. Its main use is in dealing with structures that can be considered as assemblies of interconnected subsystems which are subject to medium to high frequency vibration sources, i.e. those where the use of deterministic finite element analysis is not appropriate because of the extremely large and complex models that would be required, and the difficulty of interpreting the results of such analyses.

This volume brings together nine articles by experts in SEA from around the world. The opening chapter gives an introduction and overview of the technique describing its key successes, potential and limitations. Following chapters look in more detail at a selection of cases and examples which together illustrate the scope and power of the technique.

This book is based on a *Royal Society Philosophical Transactions* issue under the title 'Statistical Energy Analysis', but an extra chapter by Beshara, Chohan, Keane and Price, discussing nonconservatively coupled systems' is included in this edition.

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## Preface

This book contains a number of papers dealing with that part of structural dynamics known as Statistical Energy Analysis (SEA). SEA is concerned with vibrations that cannot be readily predicted using deterministic methods as the range of frequencies of interest lies above the first few modes of the structures under study, and where accurate deterministic calculations are no longer useful. As such, SEA is increasingly being used as an adjunct to finite element calculations by engineers dealing with vibration problems.

It was in 1986 that we first began working in this field and at that time, although many papers had been published on the subject only one book had appeared, that by Lyon, which was by then ten years old. Over the last decade research has continued apace and many further publications have appeared. Although Lyon's book has now been revised and republished we felt that work in this area would be served by the production, in a single dedicated volume, of a collection of papers by well respected researchers dealing with the theoretical background to SEA. To that end, in early 1993 we wrote to a number of people who we thought had made a significant contribution to the development of SEA and asked if they would care to submit a paper to such a book. A good number of those asked responded positively and this encouraged us to continue. Most of the resulting papers subsequently appeared as a theme issue in the *Philosophical Transactions of the Royal Society* in March 1994 and are now reproduced here. This volume also contains an additional paper by ourselves and our co-workers that did not appear at that time because of space restrictions in the *Phil. Trans.*

The papers presented are by no means an exhaustive treatise on the theory of SEA but they do give any engineer coming new to the field a good idea of the range of ideas being considered by those researching in the area. The first paper by Frank Fahy deliberately sets out to introduce what follows and also to set the scene on study in this area in a far more comprehensive fashion than can be accomplished in a preface. Subsequent papers then deal with topics as diverse as statistical variations in SEA modelling, modifications to the basic equations of SEA and even parallel techniques which, although using energy as the principal variable of interest, can no longer be strictly called SEA at all. Suffice it to say that we hope this collection of papers will aid and stimulate those whose interest is the vibrations of structures

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