

M. P. Norton and D. G. Karczub
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This is the second edition of the book, originally published in 1989 under Norton's sole authorship. This edition adds five sections within the eight original chapters and updates several case studies and technology descriptions found in the original.

In their preface, the authors state that there is a gap in the current offering of acoustical texts. Books on mechanical vibrations are only concerned with the details of vibration theory and do not extend to its impact on noise. Well-written texts on fundamental acoustics are targeting to engineering students, but forego practical application or case studies. Third, noise control engineering books are numerous, but are written exclusively for practicing professionals. The authors' rationale is included here because this reviewer feels that it is a viewpoint that bears consideration, and because it frames the focus and scope of the book. The purpose of their effort is to offer engineering students a unified approach to the fundamentals of engineering noise and vibration analysis and control. They aim to bring together the topics of noise and vibration into a single volume under a connected and cohesive narrative.

The book is targeted towards upper level undergraduates with a solid physics and math background, but with little or no previous coursework on the subject of acoustics. With its length and breadth, the authors intend that this single textbook can span four semesters of instruction. There are roughly 30 sample problems given for each chapter, with solutions provided in the back of the book.

The first chapter reviews the fundamentals of vibrating mechanical systems with reference to both wave and mode concepts since the dynamics of mechanical vibrations can be studied in terms of either. This part of the book assumes no previous knowledge of vibration theory. The sections on the dynamics of a single oscillator, forced vibrations with random excitation and multiple oscillators are presented using the traditional 'mechanical vibrations' approach. The section on continuous systems utilises both the traditional 'mechanical vibrations' approach and the wave impedance approach.

The second chapter, on sound waves, is a review of some fundamentals of physical acoustics. Sections are included on a classical analysis of the homogeneous wave equation, fundamental sound source models and the inhomogeneous wave equation associated with aerodynamic sound. The differences between the homogeneous and the inhomogeneous acoustic wave equations and their associated sound fields are given considerable emphasis. Basic source models, reflecting surfaces, and duct acoustics (with mean flow) are covered.

The third chapter expands on the fundamentals established in chapters 1 and 2, and is about the interactions between sound waves and solid structures. It is very important for engineers to come to grips with this chapter, and it is the most important fundamental chapter in the book. Wave-mode duality concepts are utilised regularly in this chapter. The chapter includes discussions on the basics of fluid-structure interactions, radiation ratio concepts, sound transmission through partitions, and impact noise mechanisms.

The fourth chapter is concerned exclusively with noise and vibration measurements and control procedures. While the contents may be found in many other good measurement manuals, the inclusion in an academic text is lauded. The authors do give additional attention to sound power measurements with a reflecting plane and sound intensity measurement. There is a wellplaced discussion of the economic issues in noise and vibration control from a professional perspective as well.

The fifth chapter is about the analysis of noise and vibration signals. It includes discussions on deterministic and random signals, signal analysis techniques, analogue and digital signal analysis procedures, random and bias errors, aliasing, windowing, and measurement noise errors.

The sixth chapter is specifically concerned with the application of statistical energy analysis (SEA), to the prediction of noise and vibration associated with machine structures and industrial environments, such as enclosures and semi-reverberant rooms. The underlying principles of SEA are developed and attention is given to critical variables of modal density, internal loss factors, and coupling loss factors. In addition to covering the subject for academic coursework, this chapter acts as an excellent introduction to the principles of SEA for practicing professionals not well versed in the topic.

Chapter seven is concerned with flow-induced noise and vibrations in pipelines. The discussion includes the sound field inside a cylindrical shell, the response of a cylindrical shell to internal flow, coincidence, and other pipe flow noise sources.

The eighth chapter is focused on mechanical diagnosis via source identification and fault detection. Magnitude and time domain signal analysis techniques, frequency domain signal analysis techniques, cepstrum analysis techniques, sound intensity analysis techniques, and other advanced signal analysis techniques are all adequately described. Test cases are reviewed as well.

In summary, this is a comprehensive text that deserves consideration in any acoustical library. For the student, it serves as a well-written textbook with scarcely found consideration of the applied acoustical problems that will be encountered in his or her future professional life. For the practicing professional, the book serves as a well-balanced reference manual with intermediate theoretical treatment to help him or her better understand the noise control situations commonly faced. In any case, the book is an excellent addition to the field of acoustics and noise control.

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