

## **Fundamentals of Sound and Vibration, Second Edition**

Frank Fahy and David Thompson, Editors  
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This book is directed toward graduate students in engineering, physics, or mathematics, as well as practitioners with no formal training in the field of acoustics. This is the second edition of the book originally titled *Fundamentals of Noise and Vibration*. The current edition, titled *Fundamentals of Sound and Vibration* adds two chapters on sound measurement and testing, and substantially revises the previous chapters.

Chapter 1, "Introduction," is written by editor Frank Fahy, former professor of engineering acoustics at the Institute of Sound and Vibration Research (ISVR) of the University of Southampton in the UK. It provides a concise description of sound, noise, signal processing, noise control and challenges facing the field of noise and acoustics. This provides a glimpse to come in the following chapters, which provide comprehensive information on each topic.

Chapter 2, "Fundamentals of Acoustics," is written by David Thompson, professor of railway noise and vibration and Philip Nelson, professor of acoustics, both at University of Southampton's ISVR. This chapter delves into sound pressure, one- and three-dimensional wave propagation, acoustic energy density and intensity, enclosed sound fields and room acoustics.

Chapter 3, "Fundamentals of Vibration," is written by Brian Mace, professor of mechatronics in the Department of Mechanical Engineering, University of Auckland. This chapter provides an in-depth introduction to harmonic motion, exponential notation and frequency-response functions, followed by SDOF (single-degree-of-freedom) system details of time-harmonic forced vibration and response. This leads the reader to MDOF (multi-degree-of-freedom) systems and details forced response and continuous systems, specifically highlighting vibration of rods and beams and waves in structures.

Chapter 4, "Fundamentals of Signal Processing," is written by Joe Hammond, professor emeritus and former dean of the Faculty of Engineering, Science and Mathematics, University of Southampton, and Paul White, professor of statistical signal processing at Southampton ISVR. It discusses graduate-level instruction in Fourier analysis of continuous time signals, signal and system analysis, effects of sampling, input-output relationships, and random processes and estimation including estimator errors, estimators for stochastic processes, power-spectral density, and cross-spectra, coherence and transfer functions.

Chapter 5, "Noise Control," written by David Thompson (author of Chapter 2), is useful as a practitioner's guide for sound sources, noise source quantification, principles of noise control, sound radiation from vibrating structures, and noise and vibration abatement techniques. Thompson provides an excellent and extensive reference section for the principles and techniques discussed in this chapter.

Chapter 6, "Human Response to Sound," is written by Ian Flindell, independent European acoustics consultant and retired part-time teacher and researcher at ISVR, and explores the auditory anatomy and function of the human head and ear, auditory capabilities and acoustic metrics, with updated versions of the well-known and oft-used frequency and loudness curves, and provides a discussion on the range of noise effects on people.

Chapter 7, "Human Responses to Vibration," is written by Michael J. Griffin, professor of human factors and lead researcher on human responses to vibration for the past 40 years at ISVR. The chapter takes an in-depth look at whole-body vibration, including biodynamics, discomfort, activity interference, health effects, as well as motion sickness and hand-transmitted vibration. Griffin draws on a plethora of literature-supported evidence provided in his reference section.

Chapter 8, "Measurement of Audio-frequency Sound in Air," written by Frank Fahy (author of Chapter 1), is a new section included in the second edition text and discusses microphones and specialized applications, preamplifiers and transducer electronic data systems (TEDS), calibration, sound level meters and proper usage, sound intensity and applications of sound intensity measurement. Although a relatively short section, it may be useful to the acoustic practitioner in sound measurement instrumentation, setup, calibration and data collection.

Chapter 9, "Vibration Testing," written by Tim Waters, senior lecturer in vibration engineering at ISVR, is also new section to the second edition and again provides good practitioner level details on general test set-up, sensors, using an electrodynamic shaker, and using an instrumented hammer. This chapter provides excellent free-body diagrams, acoustic graphics, and useful formulas and frequency response functions.

The text includes many functions, formulas, graphs and charts which are modern, crisp, and tied directly to the detailed text on each subject. The more math-centric chapters include problems for self-study, which may be beneficial to both student and practitioner alike. Also, each chapter provides excellent references to recent technical publications for the benefit of readers who wish to further explore each topic and extend their knowledge and understanding of acoustic and vibration technology.

In summary, the chapters are written by different authors and focus on related, but independent areas of

sound and vibration. The authors have attempted to maintain coherence and consistency of presentation by cross-reference between chapters and by complimenting the interdependency of the material. However, readers will quickly discover that this text has discrete, individually written chapters that delve into connected but uniquely identifiable topics. Each chapter is well adapted as a stand-alone reference for each particular topic area, for example, fundamentals of acoustics, vibration and signal processing, noise control, human response to sound and vibration, and finally, measurements of sound in air and vibration testing.

This book, therefore, provides a comprehensive, coherent narrative of the fundamentals of sound and vib-

ration and the associated practitioner-level components, while allowing the reader to delve into each unique topic area in greater detail. It is a well-written text that can serve the graduate-level student as well as provide the practitioner with a relevant and timely reference manual to better understand and deal with the often complicated sound and vibration issues encountered in the real world.

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