

## Acoustics — An Introduction

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*Acoustics — An Introduction* may become a high value, heavily consumed book for new acoustical engineers and for any individual with a continual interest in the science of acoustics. The breadth of the book is vast, reminding us of the far reaching scope of applied acoustics in our lives.

The book is structured in a fashion similar to many texts that cover the fundamentals for any area of technical specialty. That is, the topics are numerous and detailed, creating a good theoretical introduction into areas that the reader may use as a starting point for further study.

There are twenty (20) chapters in total, with the first 5 covering some essential concepts, including vibrating systems, wave propagation, system frequency response, sound pressure, power and intensity, and sound propagation, among other vital topics. This initial part of the book connects fundamental acoustics with the reader's everyday common experiences, such as the propagation of thunder in the atmosphere, telecommunications and physiology, among other topics. It does a good job of setting the reader's interest level for the subsequent sections in the book. The initial chapters include the following:

1. Introduction
2. Some facts on mechanical vibrations
3. Acoustic variables and basic relations
4. Plane waves, attenuation
5. Spherical wave and sound radiation

Through these initial chapters, the reader will immediately realize the clean and easily understood graphs and figures that are found throughout the book. The technical support provided by these unique contemporary illustrations is a definite asset of this book.

The next five chapters focus on sound wave interactions with various materials and boundaries. The chapters include the following:

6. Reflection and refraction — propagation of sound through various medium, including the ray propagation and the reflection, refraction and absorption due to interactions at a theoretical infinite boundary.
7. Diffraction and scattering — spherical spreading and directional properties of sound, including propagation through small apertures.
8. Sound transmission in pipes and horns — boundary interactions commonly found in any sound bounded by solid surfaces, including transmission line fundamentals, pipes with cross sectional area changes,

and resonators, covering some key topics that support the noise control and transducer sections later in the book.

9. Sound in closed spaces — room modes and modal density provide an excellent introduction to the room and building acoustics topics in subsequent sections.
10. Sound waves in isotropic solids — essential phenomena of sound wave interactions with unbounded and bounded solid structures, including plates and bars, supporting the sound transmission and noise control topics that follow in chapters 14 and 15 respectively.

The final 10 chapters address specialized topics in acoustics. The author provides a description of scientific and engineering applications for a range of areas that acoustic specialists may encounter in their work and research. The chapters include the following:

11. Music and speech — analytical details on the function of musical instruments and sounds generated by speech.
12. Human hearing — an introduction to psychoacoustic behaviors and details on most of the fundamental metrics.
13. Room acoustics — extensive discussion on room response, image sources, diffusion, absorption and reverberation, including special rooms for music and research, among others.
14. Building acoustics — characteristics of room measurements and sound isolation strategies, including high performance partitions and structure borne noise.
15. Fundamentals of noise control — mechanisms of noise generation, such as airflow, and a wide variety of noise mitigation strategies for both indoor and outdoor (environmental) applications.
16. Underwater sound and ultrasound — sound propagation and localization phenomena, with an emphasis on detection and transducer technologies.
17. Electroacoustic transducers — principles of transducer design and operations, with supporting electrical circuit diagrams.
18. Microphones — design and performance guidelines for microphones.
19. Loudspeakers and other electroacoustic sound sources — internal components and performance optimization of various source types, including speaker directivity and large arrays.
20. Electroacoustic systems — sound recording spaces, and reproduction and reinforcement systems.

During the book review process, my young child, who recently began keyboard and trumpet lessons, was very interested in my description of chapter 11. Both the details

on the mechanics of pitch and tones and the essentials behind the generation of sounds using string and wind instruments were all well received. Overall, chapters 11, 14 and 15 were found to be some of the most compelling parts of the book.

The technical depth of the book made this a very worthwhile review. The book does not focus on applications or applied acoustics very much. In fact, there are no examples or worked out problems, potentially highlighting the theory against real-life practice. This type of supporting illustration may have helped improve the overall value for the reader, although the clarity of the equations and supporting figures may help ensure that the book becomes a problem solving resource for many years.

The breadth of acoustical topics and the corresponding theoretical details make this a complete introduction to the science of sound and vibration. The unique graphics and tables will help make this a handy desktop tool for acoustic engineers and scientists involved in applied acoustics. It is recommended as an essential read for someone studying acoustics for the first time and as an essential resource for seasoned professionals.

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