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In 1960, *Noise Reduction*, edited by Leo L. Beranek and based on the Special Program on Noise Reduction held at MIT, was published. In *Noise Reduction*, Beranek brought together several experts in the field of noise control engineering as authors of chapters of this book. Leo's editing was responsible for a coherent package that began one of the hallmark books on noise control. In 1971, Leo edited *Noise and Vibration Control*, the successor to *Noise Reduction*. This book followed the same format with most of the chapters written by new authors. A revised edition of *Noise and Vibration Control* is now published by the Institute of Noise Control Engineering (INCE) as the 'Green Book'. In *Noise and Vibration Control*, Istvan Ver was the author of the chapter on structural acoustics.

Istvan Ver joined Leo in editing the completely new book, *Noise and Vibration Control Engineering*, again using the same format used in the first two books edited by Leo. Individual chapters on specific topics were authored by experts in their respective field, and edited into a coherent volume by Beranek and Ver.

The subject of this review is the second edition of *Noise and Vibration Control Engineering*. Here, Istvan Ver is listed as the lead editor with Beranek listed second. My reading of the other three books edited by Beranek and Ver, and this one edited by Ver and Beranek indicate that both played an important role in this book, both as authors and editors. Istvan has expanded his direct contribution to this book as sole author of new chapters and coauthor other chapters. As noted below, some of the chapters in the second edition of *Noise and Vibration Control Engineering* have been updated without extensive revisions, some have been extensively revised or re-written and others are completely new to this book. Three chapters from the first edition are not included in the second edition; *Noise and Vibration Control of Internal Combustion Reciprocating Engines*, *Noise and Vibration of Electronic Machinery*, and *Elements of Gear Noise Prediction*, which were the last three chapters in the first edition.

The first four chapters deal with basics that underpin noise control engineering. Because the basics have not changed for decades, certainly since the first edition of *Noise and Vibration Control Engineering* was published, the first four chapters remain largely unchanged. The authors of the first three chapters are the same. For Chapter 4, Matthew Nobile and Jiri Tichy replaced Leo as authors. Acoustic pressure, intensity, particle velocity and power, and their respective levels and spectra are described in Chapter 1, *Basic Acoustical Quantities: Levels and Decibels*, by Leo. Leo then discusses wave and impedance in Chapter 2, *Waves and Impedances*, which introduce wavenumber, resonance of simple sources, plane and spherical waves, and of course impedance and admittance. Chapter 3, *Data Analysis*, by Allan Piersol, begins with descriptions of different types of signals and methods of their analysis. Basic properties of digital signal processing, e.g. the Fast Fourier Transform (FFT), and correlation functions are presented. Examples of applications of data analyses are given. William Lang, George Maling, Matthew Nobile and Jiri Tichy author Chapter 4, *Determination of Sound Power Levels and Directivity of Noise Sources*. Here, nearfield, farfield and reverberant fields, determination of sound power from sound pressures measured in reverberant and free fields, and measurement of the directivity of acoustic radiation are considered.

Chapter 5, *Outdoor Sound Propagation*, has been rewritten by Ulrich Kurze and Grant Anderson. Included in this chapter are methods of measuring levels from moving and stationary sources outdoors. Elements affecting outdoor sound propagation, such as ground reflection, refraction, barriers and absorption, are discussed. Assembling these factors are considered, along with associated uncertainties.

Chapter 6, *Sound in Small Enclosures*, have been revised and updated by Donald Nefske and Shung Sung. Enclosures with dimensions smaller than an acoustic wavelength and enclosures with dimensions large enough to contain a small number of modes are considered. The effects of non-rigid enclosure boundaries and coupling between surface vibration and interior acoustic modes are treated. Tables of equations for resonant modes for different boundary conditions are included. Also considered are forced and transient responses to excitation by random noise and pure tones at resonance frequencies. Examples are given to illustrate the use of the somewhat complex equations presented in this chapter.

Chapter 7, *Sound in Rooms*, has been re-written by Murray Hodgson and, the new author, John Bradley. Factors controlling acoustics in rooms, introduce this chapter, followed by a discussion of diffuse sound fields. Methods for predicting sound fields in rooms are discussed. A new section on classroom acoustics has been added. Industrial and open-plan office spaces are considered. The chapter closes with a discussion of reverberant and anechoic spaces. Speech intelligibility is included in the discussion of classrooms. I missed not having a brief discussion of performance halls where instead of speech, perception of music is a factor.

Chapter 8, Sound-Absorbing Materials and Absorption, has been re-written by Keith Attenborough (new author) and Istvan Ver. This chapter begins with methods for measuring absorption. Locally and non-locally reactive layers are considered in terms of flow resistance and impedance. Mechanisms of absorption are expressed in terms of physical properties and complex wavenumbers. Absorption of normal-incident and oblique-incident sound by thin and thick, multi-layered and air-backed flat panels is treated. This chapter closes with a discussion on resonance absorbers, e.g. Helmholtz and plate or foil absorbers.

Chapter 9, Passive Silencers, has been re-written by M.L. Munjal (new author), Anthony Galaitsis and Istvan Ver. This chapter begins with a review of the extensive literature on silencers, which include both reactive silencers (mufflers) and dissipative silencers. Active control of lined ducts is considered in Chapter 16 and active control of silencers in Chapter 17. Descriptions of silencer performance and modeling techniques are presented next in Chapter 9. Examples of how to use modeling equations, along with several graphs in which silencer performance is plotted for different parameters, are presented. Effects of temperature and flow on acoustic performance are discussed. Pressure drop in silencers is also considered in this chapter.

Chapter 10, Sound Generation, by Istvan Ver is new. The basic mechanisms of radiation by small bodies is discussed first. The effects of the shape of the radiating body and surrounding boundaries (e.g. baffling) are considered. Equations, supplemented by a table of fillin factors, are presented for different types of radiating bodies. The nearfield is discussed. This chapter ends with a discussion on methods for reducing radiation. After wading through many useful equations, I would have liked more guidance on how to apply all of the information presented in this chapter to reducing sound generation for sources, particularly real sources.

Chapter 11, Interaction of Sound Waves with Solid Structures by Istvan Ver has been revised and expanded without losing the good stuff that was in the first edition. At 128 pages, this is the second longest chapter in this book (the longest is Chapter 18 on active control) The material now covered in Chapter 10 has been removed from this chapter. Sections on transmission through small partitions and on the equivalence of force and acoustic excitation have been added. Material on waves in solids, impedance and power input, modal density, reflection and transmission at interfaces, transmission through structural junctions, sound radiation from structures, sound excitation of structures and sound transmission through partitions are all included in this chapter. Statistical Energy Analysis (SEA) is reviewed. Reciprocity is discussed. Impact noise is also covered. Tables at the end of the chapter give numerical values and/or equations for acoustic properties of solids, impedance of and input power to structures, resonance frequencies and radiation efficiency.

Chapter 12, Enclosures, Cabins and Wrappings, has been updated and expanded by Istvan Ver. Enclosures are divided into three sizes: small, intermediate and large, according to their dimensions relative to the acoustic wavelength. Effects of openings (leaks), flanking, internal absorption and material properties are considered. Models illustrate basic properties of enclosure performance. Wrappings are also treated.

Jeffrey Zapfe helped Eric Ungar update Chapter 13, Vibration Isolation, and Chapter 14, Structural Damping. In the first edition, these two chapters have withstood the test of time and needed only moderate revisions. Chapter 13 begins with the simple oscillator used to illustrate basic properties of vibration isolation. Foundation impedance, high frequency excitation, force/velocity sources and isolated mass are considered. Two-stage mounting systems are discussed. Practical guidelines are offered. Rubber mounts, with the shape factor, are treated. Chapter 13 begins with a discussion on what damping can do and what it can not do. Descriptions of damping are presented along with methods for the measurement of damping. Reduced frequency plots for damping properties of materials are explained. Damping at boundaries, by acoustic radiation and by material properties are considered. Discussions of free-layer and constrained-layer damping treatments close this chapter.

Chapter 15, Noise of Gas Flows, has a new author, W.B. Coney, who joins H.B. Baumann. This chapter has been re-written, with the section on measurement conditions for open-jet wind tunnels dropped and sections on noise from flow in pipes and on flows past cavities added. Basic sound mechanisms of flow-generated noise are treated first. Noise generated by jets, turbulent boundary layers, and flow over grilles, airfoils and struts are reconsidered. Value noise is also included in this chapter. Complex equations, necessary for the description of flow noise, are presented and their use illustrated in four examples.

Chapter 16, Prediction of Machinery Noise has been expanded with James Barnes joining Eric Wood who wrote this chapter for the first edition. Equations and tables for estimating A-weighted and octave band sound power levels are presented for compressors, boilers, coal-handling equipment, air-cooled condensers (new), diesel-engine-powered equipment, industrial fans, pumps, gas and steam turbines, steam vents, transformers and wind turbines (new). References are given for those who seek more details. Noise treatments of sources are offered.

Chapter 16, Noise Control in Heating, Ventilating and Air Conditioning Systems by Alan Fry and Douglas Sturz is new. Methods for estimating losses for acoustic propagation in ducts are presented. Guidelines for flow velocities in ducts are given for different room criteria. Duct break out and break in, fans, terminal boxes, equipment rooms, vibration isolation and outdoor equipment are all considered but without equations or data. This is a departure from the rest of this book where prediction methods supported by equations and data, often in graphs and tables, are often given. In additions, no discussion is presented in this chapter on how to derive estimates for a complete HVAC system.

Chapter 18, Active Control of Noise and Vibration has been completely re-written by new authors, Ronald Coleman and Paul Remington. In the first edition, the chapter on active control was 30 pages. In this edition, it is 136 pages, the longest chapter in this book. Basic principles of how active control works and placement of actuators and sensors are illustrated and discussed. Differences between feedback and feedforward architecture are explained. The basics of digital filters, essential to active control, are reviewed with equations and graphs. Next, detailed descriptions of feedforward systems are presented and illustrated with examples. Here, anti-aliasing is discussed. Feedback systems, with filter design for stability, are covered and illustrated with examples. Active control design considerations, performance goals and placement of sensors and actuators are treated. References are made to MatLab software. Analog-to-digital and digital-to-analog converters are considered. Detailed examples of the feedforward active control of locomotive exhaust noise, the feedback active control of machinery vibration isolation and the active control for a zone of quiet in a ship sleeping berth are used to illustrate the material presented in this chapter.

Suzanne Smith joins Charles Nixon and Henning Van Gierke to update and revise Chapter 19, Damage Risk Criteria for Hearing and Human Body Vibrations. The primary update is on human body vibration criteria. Different criteria for hearing loss are presented for steady-state and impact noise, and for infrasonic and ultrasonic exposure. Hearing protectors are considered without discussions of hearing protector performance measures, such as Noise Reduction Rating (NRR). The effects and criteria for whole body and hand/arm vibration close this chapter.

Chapter 20, Criteria for Noise in Buildings and Communities, has been revised and updated by Leo Beranek. Criteria for rooms focus on HVAC noise. Tables for A-weighted sound level, Noise Criteria (NC), Room Criteria (RC-Mark II) and Revised Noise Criteria (RNC) are given, along with discussions on how to compute NC, RC and RNC ratings. A brief discussion on acoustically-induced vibration, and community and urban noise close this chapter.

Chapter 21, Acoustic Standards for Noise and Vibration Control by Angelo Campanella, Paul Schomer and Laura Ann Wilbur is new. This chapter is a very handy listing of over 200 standards, many with brief descriptions. Standards include measurement of sound pressure and power level for different sources, hearing testing, vibration, propagation inside (e.g. transmission loss) and outside (e.g. barriers), sound absorption and in rooms (e.g. reverberation and open-plan offices).

Although most chapters contain extensive reference lists, a reference list of general interest to noise control engineers is given in Appendix A. Appendix B discussing the much-loved American System of Units. Finally, Appendix C has the very useful list of conversion factors given in all three of the preceding books edited by Beranek and Ver. Throughout this book, references are made from one chapter to another, where appropriate, which helps to tie chapters together and avoid repetition.

Some things get better with age, e.g. women, wine and pea soup. This is also true here. Each new book in this 'series' of books started by Leo Beranek in 1960 and continued with help from Istvan Ver has gotten better. They all maintain a depth that is not available in many of the other books available on noise control. This book has a excellent balance of practical and therefore useful guidelines and theoretical modeling with equations and data to support and permit easy extension of the guidelines to most of the situations faced by noise control engineers. In general, one will not be buried in math that does not lead to meaningful help for noise control engineers looking for solutions to real problems. Anyone serious about noise control should have this book available, even if you are like me and have the other three preceding books in this 'series'.

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