Architectural Acoustics, Second Edition
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This book is a thorough compilation of acoustic principles and applications for room acoustics, sound isolation, noise control and sound reinforcement systems. From the author's preface, the book's goal was to provide an organized approach to acoustic interactions combining theoretical background and practical examples to enable an intellectual framework for thinking about the subject matter. *Architectural Acoustics* admirably attains this goal.

I have used the first edition of the book since 2006 for my Architectural Acoustics and Noise Control classes at Peabody Institute of Johns Hopkins University. The book has been well received by students and the chapter topics are logically organized to enable effective teaching. Of particular note is the presentation of data and figures, all which use the same graphical formatting, giving a unified appearance that is easy to comprehend.

The book comprises 22 chapters arranged in a logical sequence starting with historical perspectives, progressing to acoustic and perceptual fundamentals, outdoor sound propagation, sound isolation, mechanical vibration and noise control, room acoustics applied to different building types, sound reinforcement systems and finally acoustic modeling.

The first chapter covers acoustic history, starting with the Greeks, with a primary emphasis on religious and music performance buildings and featuring precedent setting examples.

Chapters 2 and 6 review acoustic fundamentals to include a general description of sound, source characterization, levels and loudspeakers to aid readers with the chapter topics that follow. It would seem apt that the material in Chapter 6 might better follow Chapter 2.

Basic psychoacoustics is presented in Chapter 3 with emphasis on loudness, speech intelligibility, health and safety and audibility of sound reflections enabling readers to understand the perceptual implications of acoustic design.

Chapter 4 addresses acoustic measurements and metrics to include basics of microphones and sound level meters, quantifying environmental noise and an introduction to specialized measurements such as time delay spectrometry, sound intensity and speech intelligibility. My one criticism here is the over reliance on RASTI for speech intelligibility assessment. Work by Peter Mapp and others have shown this metric not to be as accurate as the full STI or abbreviated STIPA metrics.

Chapter 5 reviews environmental noise with a particular emphasis on exterior sound propagation, barriers and traffic noise modeling. Of interest is the thorough description of sound absorption by air.

Sound reflection and absorption are the topics of Chapter 7 with emphasis on coherent reflections, reflections from finite objects, absorption mechanisms and special sound absorbers such as panels and resonators. Sound reflections from ceiling panel arrays are covered based on the work of Rindel.

Chapter 8 is a logical sequence to the previous chapter and describes the theory of sound propagation in enclosed spaces, starting with one-dimensional pipes and ducts and progressing to three-dimensional spaces with explanations of room modes, diffuse field theory sound propagation, reverberation equations and examples where deviations from diffuse field behavior occur.

Chapters 9 and 10 cover sound transmission loss properties and sound transmission in buildings. This reviewer has found these two chapters to be one of the best presentations of these topics in an acoustics book. Chapter 9 addresses sound transmission loss theory for various idealized panel configurations. Chapter 10 is more practical and covers sound transmission for various conditions: reverberant-to-reverberant, free field-to-reverberant and transmission into absorptive spaces and through large openings. A unique feature is the treatment of the direct field transmission component for reverberant conditions and sound levels near and remote from the radiating surface. One minor criticism is the use of the term "R" for transmission loss which is not consistent with North American nomenclature.

Vibration and vibration isolation are the subjects of Chapter 11. Its placement in the book, between chapters on airborne sound transmission and structure-borne sound transmission may seem out of place but makes sense as approximately one-fourth of this chapter addresses floor vibrations from human activities. The theory of single and double degree of freedom vibration-isolated systems is reviewed, along with practical applications of vibration isolator selection for mechanical equipment and support of vibration-isolated equipment.

Chapter 12 covers noise transmission in floor systems with review of airborne, impact and floor squeak noise. An interesting aspect of this chapter, which differs from other acoustics books, is separating impact noise from walking into footfall and structural deflection components. These discussions, plus the cited references, have provided new understanding of these transmission mechanisms to this reviewer. Now I know the cause of those pesky floor squeaks in my house!

Noise generation and control for mechanical systems are described in Chapters 13 and 14. The first chapter

reviews mechanical equipment, both air handling and refrigeration devices, in terms of its functions and noise generation. Chapter 14 briefly reviews sound attenuation in ducts, plenums, sound attenuators and duct breakout and break-in phenomena, concluding with a typical mechanical system noise prediction calculation.

Chapters 15 and 16 provide an overview of issues relating to acoustic design for multi-family dwellings and office buildings. Both chapters have an emphasis on speech privacy and considerations for mechanical equipment noise control. Guidance is provided on sound isolation and privacy expectations as related to assembly construction and acoustic performance ratings.

Design of rooms for speech is the topic for Chapter 17. Issues include general design criteria, sightline analysis to maximize direct sound propagation, room shaping, reverberation limits, comparison of different speech intelligibility metrics and applications to different room types. An interesting feature is the section on restaurant design. Many concepts in this chapter are directly applicable to the following chapters on music and multi-purpose auditoria.

As an extension of Chapter 17, sound reinforcement system design, is covered in Chapter 18, starting with a review of different loudspeaker types and following with design concepts for system electronics, loudspeaker directivity parameters, and lastly, computer modeling to include information on loudspeaker coordinate geometry.

Chapter 19 covers design of concert and opera halls. The chapter condenses much of the work from the past 30 years with emphasis on contributions by Barron, Beranek and Bradley. The chapter concludes with a survey of significant venues summarizing physical and acoustic data for each.

Chapter 20 describes acoustic design for multi-purpose auditoria, recital halls and worship house sanctuaries to include illustrative examples. The chapter supplements material from earlier chapters with diverse subjects such as stage shell, pit and platform design, variable acoustics (both passive and active), coupled chambers and integrating sound reinforcement systems.

The design of small rooms is reviewed in Chapter 21. Topics include room modes, effects of discrete sound reflections, low-frequency sound control, loudspeaker placement, diffusion and sound isolation for recording, rehearsal and listening rooms. The acoustic design for scoring stages and Foley studios is a subject not covered in other acoustics books.

The last chapter reviews acoustic modeling, ray tracing and auralization as means to predict and evaluate room acoustic behavior. Information in this chapter will be useful to help understand commercial room acoustic programs that are available.

In summary, the second edition of *Architectural Acoustics* provides a comprehensive overview to the many aspects of architectural acoustics, sound isolation, equipment noise control and sound reinforcement systems, balancing both theoretical and practical considerations. A reader with no background in acoustics will be able to understand the topics because of introductory material presented before relevant chapters and the author's unambiguous writing style. This book will serve as an excellent textbook for a yearlong course for upper level undergraduate or graduate students. Practitioners will find much value in the concise summaries contained in this revised volume.

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