Available online at www.sciencedirect.com
SCIENCE DIRECT
Journal of Sound and Vibration 295 (2006) 1105–1106
JOURNAL OF SOUND AND VIBRATION
www.elsevier.com/locate/jsvi

Book Review

Trevor J. Cox, Peter D'Antonio, Acoustic Absorbers and Diffusers: Theory, Design and Application, Spon Press, London, New York. 432pp, £ = 95.00 ISBN 0-415-29649-8.

One of the pleasures of working in room acoustics in the 1960s and beyond was discovery of a new paper by Prof. Manfred Schroeder. Often just a few pages long but likely to turn one's views upside down, as when he proposed measuring reverberation time by integrating in reverse time. True to form, Schroeder's 1975 paper "Diffuse sound reflection by maximum-length sequences" (Journal of the Acoustical Society of America, **57**, 149–150) in a mere two pages introduced the concept of determinate scattering, a possibility unknown until then. Soon after, Schroeder proposed a broad-band diffuser design based on quadratic residue sequences, which was exploited for the first time in a new 2570 seat concert hall in Wellington, New Zealand, by Marshall and Hyde.

The use of these diffusers might have remained a specialist pursuit but their value in recording studios and associated control rooms soon became apparent. This led to Peter D'Antonio setting up a company to sell this type of diffuser commercially and working with Trevor Cox to develop testing systems and other diffuser types. This book is a very valuable summary of their understanding of the acoustics of absorbers and diffusers, stimulated by their experiences working on innovative wall treatments.

The traditional form for books containing moderate amounts of theory is to present the theory then move on to practical applications. Following a short introduction, this book starts with two chapters considering the applications and basic principles of absorbers and diffusers. This 'reverse' approach is welcome and definitely whets the appetite for what is to come. Measurement methods for each are then considered followed by three chapters dealing with different types of absorbers. Over the years, a considerable amount of work has been conducted and published by others on absorption, with for instance three volumes on the topic written in German by Prof. Mechel. What is presented here is a valuable, accessible summary of the principles behind the various absorbers now available.

The remaining half of the book is concerned with the topic which the authors are particularly associated with: scattering by profiled surfaces. The text becomes significantly more challenging at this point; not only are there questions about prediction methods and whether various simplifications proposed by Kirchhoff, Fresnel, etc. are valid but the number of variables one has to deal with becomes large. Scattering is always strongly dependent on frequency. A whole chapter is dedicated to phase grating diffusers, now universally known as Schroeder diffusers. While many readers will be familiar with quadratic residue and primitive root diffusers, most may not realize the problems that arise due to periodicity (repeating a sequence several times) and the methods that can be used to remove them by modulating the overall sequence by a further binary sequence. Yet the conclusion about these diffusers is that "the magic in the Schroeder diffuser geometry is not that it produces diffusion, but that it enables simple design methods to be brought to bear on the problem. […] Measurements [have] confirmed that optimization produced better diffusers than number theory sequences." However, the main difficulty with Schroeder diffusers is that designers are often unenthusiastic about their visual character. Optimization is the way forward; this can be done with a wide range of possible shapes such as convex elements, which are likely to be visually more acceptable. Methods and techniques for optimization are discussed in some detail. It will be interesting to see what surface designs emerge in the future, that are both pleasing to the eye and acoustically diffusing.

Discussion of wall treatment concludes with consideration of hybrid surfaces (providing both absorption and scattering) and active surfaces (employing electro-acoustics). The penultimate chapter looks at input

doi:10.1016/j.jsv.2006.01.055

parameters for absorption and scattering for use in computer simulation programs; though there are few definitive conclusions, this discussion will be very valuable for programmers.

I have only one gripe with the content of this book, which is the recommendation to use Kath and Kuhl's technique for measuring seat absorption in reverberation chambers. This method uses barriers round the seating, yet evidence indicates that this gives incorrect values at low frequencies due to diffraction round the barriers. Indeed the discussion in Sections 12.2 and 12.3 refers to these very problems.

Overall, however, this is a most welcome book. It is copiously illustrated with figures which back up the major points being made. The book provides a valuable text on absorbers, while in the case of diffusers it is likely to remain the standard text for a good while.

Mike Barron
Department of Architecture and Civil Engineering,
University of Bath, Bath BA2 7AY, UK
E-mail address: m.barron@bath.ac.uk