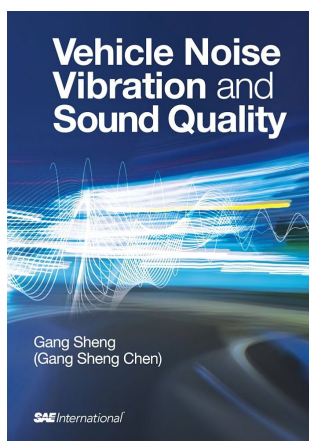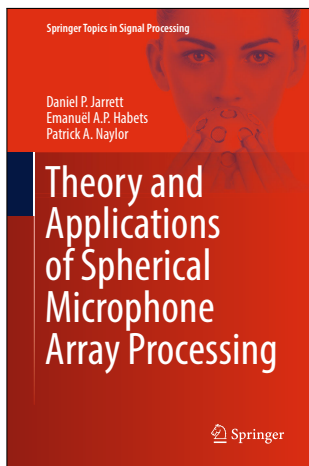## Reviews A&V n. 55

Book Reviews

In this issue, we have four reviews

In this issue of the journal, we are pleased to present an exclusive selection of four book reviews, commonly referred to as *Book Reviews*. All reviews are available in Portuguese (p.51), English (p.57), and Spanish (p. 63).

It is worth emphasizing that these reviews were written concisely and objectively, aiming to summarize the content of both newly published works and classic references that broadly cover the fields of acoustics, vibrations, and audio. In addition, the reviews provide relevant information about the authors, thereby enriching the context of each analyzed work.

In this edition, we highlight the following books:

- Theory and Applications of Spherical Microphone Array Processing

  Authors: Daniel P. Jarrett, Emanuël A.P. Habets, and Patrick A. Naylor | Springer, 2017

- Processamento de Sinais em Acústica e Vibrações

  Author: Roberto A. Tenenbaum | Blucher, 2024

- The MEMS Microphone Book

  Author: Mikko Suvanto | Mosomic, 2022

- Vehicle Noise, Vibration, and Sound Quality

  Author: Gang Sheng | SAE International, 2012

Gathered in these four works is a wide range of topics, from the fundamental principles of sound to microphone array techniques, acoustic signal processing methods, microphone properties and applications, and, finally, a comprehensive discussion of vehicle acoustics. Each book stands out by effectively combining theory and practice — whether through computational models or detailed descriptions of practical experiments — establishing themselves thus as particularly valuable reading for students and professionals seeking to deepen their knowledge and skills.

We hope that reading these reviews will provide the first impressions and reflections on these works, inspiring the desire to explore them in their entirety — a valuable strategy for expanding one's theoretical repertoire and staying up to date in the field.

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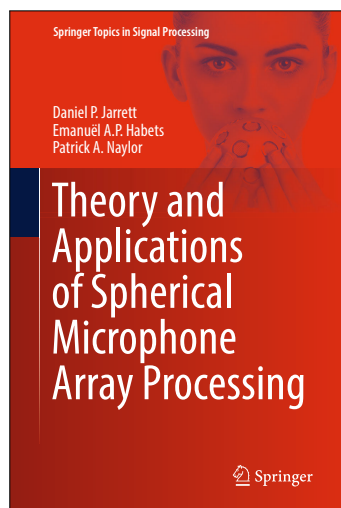
Authors: Daniel P. Jarrett, Emanuël A.P. Habets, and Patrick A. Naylor
Publisher: Springer
Year: 2017
Language: English
ISBN: 978-3319422091
DOI: 10.1007/978-3-319-42211-4

Figure 1: Example of a spherical array with 32 microphones, the Eigenmike em32 from mh Acoustics (source: official website).

Theory and Applications of Spherical Microphone Array Processing

The spherical world of arrays compiled in one edition

Published in 2017 by Springer, *Theory and Applications of Spherical Microphone Array Processing* has established itself as a key reference in the field of acoustic signal processing using spherical microphone arrays. Balancing theoretical rigor with practical applications, the book provides a solid foundation for researchers, engineers, and graduate students with interests in acoustics, signal processing, and electrical engineering. Its clear exposition and wide-ranging content make it essential reading for anyone seeking a deeper understanding of the principles underlying three-dimensional audio capture and processing.

Organized in a progression from theoretical premises to concrete implementations, the work contextualizes the historical and technological significance of spherical arrays. It begins by introducing spherical harmonics and spherical array acoustic impulse responses, highlighting also their applicability in reverberant environment simulations. Subsequently, it delves into beamforming and spatial analysis techniques — both adaptive and signal-independent — with an emphasis on statistical parameter estimation. These concepts undergird the development of algorithms for spectral decomposition, source localization, and acoustic scene parameterization, encompassing direction-of-arrival (DOA) and sound diffusivity.

Among its most notable contributions is the blend of theoretical and practical perspectives, which unites expansions in spherical harmonics with the implementation of spherical beamforming, which may be used for noise control in videoconferencing and three-dimensional capture for virtual reality. The work's didactic clarity shines through in its treatment of complex topics, such as spatial sampling, illustrated through numerical examples and elucidative figures. The text also investigates beamforming optimization methods, contrasting minimum variance distortionless response (MVDR) with maximum signal-to-noise ratio (SNR) criteria, for example. By linking these methodologies to applications in room acoustics, dedicated systems, and distributed microphone networks, the authors demonstrate the versatility of spherical arrays in the age of acoustic automation.

Geared toward an audience already familiar with signal processing, the book offers valuable insights for projects ranging from immersive audio and telecommunications to robotic navigation and environmental monitoring. Although its scope is extensive, prior knowledge of spectral analysis and linear algebra is advisable. Even so, the text transcends the limits of a mere technical manual, serving as an academic treatise that spurs future research while reaffirming the prominent role of spherical arrays at the forefront of modern acoustic engineering. It can be purchased in either the physical version or the digital one.

Inserts

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PROCESSAMENTO DE SINAIS EM ACÚSTICA E VIBRAÇÕES

Signal Processing in Acoustics and Vibrations

A presentation on signals and systems for A&V

With his "*Signal Processing in Acoustics and Vibrations (Processamento de Sinais em Acústica e Vibrações)*", Roberto Tenenbaum has written a textbook that combines the fundamentals of signal processing with acoustic applications and vibrations in a unique way. This book provides all the fundamentals of signal analysis for linear phenomena of sound and vibration in various applications, both for measurement technology and for numerical simulation. It can already be described as a reference work in Portuguese for all teachers and students of acoustics and vibrations. All the facts are based on the laws of physics and are presented very clearly and vividly. As with virtually all textbooks on acoustics and vibrations, basic knowledge of mathematics and physics is a prerequisite for reading.

The Introduction offers a wonderfully intuitive approach to the concepts of "signals" and "systems" in stationary and transient processes in physics and technology. The author elegantly introduces the mathematics of the theory of signals and systems by describing observations in continuous and discrete time and allows the reader to understand the basic approaches at a general level. In Part A, for continuous signals, and Part B, for discrete signals, signal analysis in the time and frequency domain, filtering, correlation analysis, and other algorithms are elaborated in great detail. Particularly noteworthy is the excellent didactic approach in illustrating the abstract mathematical derivations with numerous examples, which greatly facilitates learning with the aim of gaining a thorough understanding of even complex processes. Even more illustrative is the conclusion in Part C, with practically all the most important standard applications of signal processing in measurement and calculation methods in acoustics and vibrations.

This book is an excellent source of information for anyone who wants to learn more about acoustics and vibrations or who is already working in these areas. It is a collection of a wealth of knowledge and experience in signal analysis and processing. It is essential reading, especially for students or beginners in this field, but also as a reference work for all practical tasks.

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The MEMS Microphone Book

A practical guide to reliable high-quality sound capturing with miniature microphones

Mikko Suvanto, a renowned expert in miniaturized microphones, presents in *The MEMS Microphone Book: A Practical Guide to Reliable High-Quality Sound Capturing with Miniature Microphones* a comprehensive reference work on MEMS (Microelectromechanical Systems) microphone technology. Published in 2022, with over 600 pages, the book synthesizes more than two decades of the author's industry experience, offering a detailed overview of this emerging technology and its applications.

The structure of the book stands out for its encyclopedic nature, organized into concise sections, independent paragraphs, and extensive use of bullet points. As the author notes, those who read the book *cover to cover* will encounter a certain amount of information repeated across chapters, with the aim of facilitating access to contextualized content. Although this approach may seem unusual for a technical text, it proves highly functional by allowing quick access to specific information. In addition, the inclusion of a detailed index and a well-defined content structure solidifies its value as a reference resource for engineers and researchers.

The depth of the work is one of its greatest strengths. Suvanto begins by reviewing basic acoustic concepts. He then presents an overall overview of the construction of capacitive microphones, as well as the figures of merit and testing methodologies used to describe and assess their performance. From the eighth chapter onward, the author delves into the unique universe of MEMS microphones, exploring everything from the internal structure of these devices to the factors that determine their performance, providing a comparison with conventional technologies.

Throughout the text, discussions about differences in topologies, design processes, and electrical interfaces of these microphones stand out, informing the reader about aspects often overlooked in the available literature. In addition, the author devotes significant attention to practical issues such as the effective implementation of MEMS microphones, addressing mechanical, acoustic, and electrical aspects, wind noise mitigation, and array configuration as well as demonstrating a commitment to the applicability of the knowledge presented. Beyond the book, the author offers a free online course (Mosomic MEMS Microphone Guide) on YouTube that details and explains various aspects of microphones.

The MEMS Microphone Book fills a significant gap in the technical literature, establishing itself as an essential source of information for those working with sound capture in modern devices. Its accessible format and extensive content make it indispensable for audio industry professionals, hardware engineers, and researchers. Suvanto delivers a work of undeniable relevance, whose contribution to the field of MEMS microphone technology will remain valid for many years. Further details can be found on the author's website, and physical copies are available for purchase.
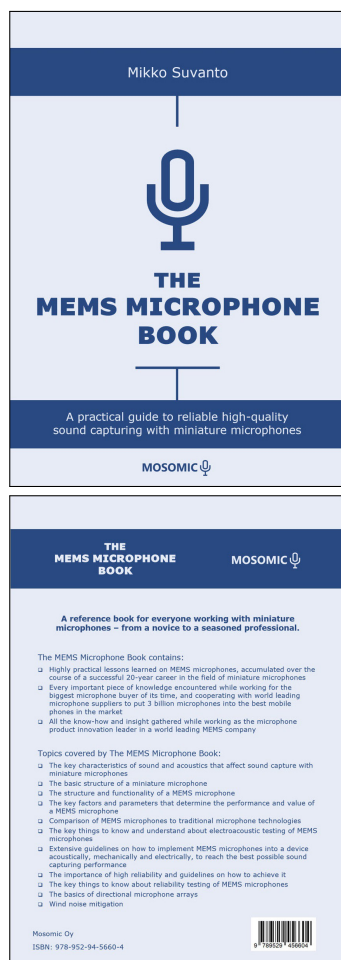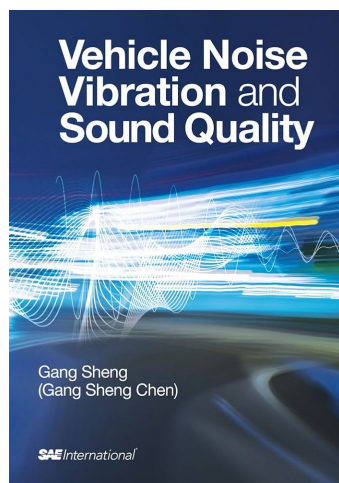
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Inserts

Vehicle Noise, Vib., and Sound Quality

A compendium on vehicle acoustics

The book *"Vehicle Noise, Vibration, and Sound Quality,"* by Gang Sheng, is essential reading for anyone beginning in the field of automotive acoustics, as it covers the main concepts of noise, vibration, and sound quality in vehicles. Intended for engineering students, researchers, and engineers who wish to expand their knowledge in the area, the work also offers value to experienced professionals in the automotive industry.

The author systematically introduces vehicle vibrations and noise, explaining how these phenomena are generated, transmitted, and perceived both inside and outside vehicles. Key concepts and noise and vibration control techniques are discussed. Sheng also addresses fundamental measurement and analysis methods for identifying and mitigating problems, with relevant references at the end of each chapter for those seeking greater mathematical rigor or technical depth.

Published in 2012, the work stands out for considering the new generation of vehicles, which have different requirements in terms of vibration and sound, in addition to traditional noise control demands. Drawing on his experience as a researcher, professor, and consultant for North-American companies, Sheng fills gaps in the literature by integrating principles, analytical approaches, and testing techniques. Although the content focuses primarily on combustion vehicles, its comprehensive nature remains highly relevant in the industry. For specific aspects of electric and hybrid vehicles, readers may consult other references, such as the book *"Noise, Vibration and Harshness of Electric and Hybrid Vehicles,"* by Lijun Zhang, Dejian Meng, and Gang Chen.

One of the book's strengths is its integration of theory and practice through case studies that address a vehicle's various systems and components, demonstrating how noise and vibration control techniques apply to different types of vehicles, ranging from passenger cars to heavy commercial vehicles. These examples make the content more tangible and relevant, aiding in the understanding of real industry problems.

Sheng also explores the importance of sound quality and how it influences user experience. The author describes methods for evaluating and enhancing this aspect, emphasizing not only technical factors but also the subjective perception of the occupants.

In summary, *"Vehicle Noise, Vibration, and Sound Quality"* is a comprehensive and accessible resource on challenges and solutions for noise, vibration, and sound quality in vehicles. Its combination of solid theory and practical examples makes it an indispensable reference for professionals and academics seeking to improve comfort and tranquility within automobiles. The work can be purchased in both physical and digital formats.