NOISE/NEWS INTERNATIONAL

Volume 25, Number 1
2017 March

A quarterly news magazine with an Internet supplement published by I-INCE and INCE-USA

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Volume 25, Number 1 **2017 March**

Features

Departments

Cover image: Photo courtesy of Maggie Wong.

Produced by
The Institute of Noise Control Engineering of the USA, Inc.
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USA

Noise/News International is a quarterly news magazine published in pdf format only by the International Institute of Noise Control Engineering (I-INCE) and the Institute of Noise Control Engineering of the USA, Inc. (INCE-USA). Noise/News International is available for free download to members of INCE-USA, the members of Member Societies of International INCE and others. Thus, the availability of NNI is a benefit to these members, and to the noise control engineering community. Advertising sales are handled by Cathy Vail. Feature articles for this magazine are selected by the editors. Responsibility for editorial content rests upon the authors, and not upon I-INCE or INCE-USA, the Member Societies of I-INCE, or their members. Product information is published as a service to our readers, and does not constitute an endorsement by the societies or their members. **SUBSCRIPTIONS:** The Member Societies of International INCE and members of INCE-USA will be notified by e-mail when a new edition of NNI has been posted on the NNI website and is available for download. Anyone who wishes to be notified by e-mail of the availability of NNI for download may go to the NNI website and sign up as a subscriber. Any problems related to sign-up or other issues should be directed to the Institute of Noise Control Engineering Business Office, 11130 Sunrise Valley Dr., Suite 350, Reston, VA 20191-4371. **EDITORIAL CORRESPONDENCE:** Address editorial correspondence to James K. Thompson, PhD, PE, INCE-USA Business Office, 11130 Sunrise Valley Dr., Suite 350, Reston, VA 20191-4371. Telephone: +1.703.437.4073; fax: +1.703.435.4390; e-mail: jktprof@outlook.com

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NOISE/NEWS INTERNATIONAL

This PDF version of Noise/News International and its Internet supplement are published jointly by the International Institute of Noise Control Engineering (I-INCE) and the Institute of Noise Control Engineering of the USA (INCE-USA). This is the third volume that is being published in PDF format only. The PDF format means that the issues can be read by freely available software such as that published by Adobe and others. It reduces publication time, saves printing costs, and allows links to be inserted in the document for direct access to references and other material. Individuals can sign up for a free subscription to NNI by going to the web site http://www.noisenewsinternational.net.

I-INCE

The International Institute of Noise Control Engineering (I-INCE) is a worldwide consortium of societies concerned with noise control and acoustics. I-INCE, chartered in Zürich, Switzerland, is the sponsor of the INTER-NOISE Series of International Congresses on Noise Control Engineering, and, with the Institute of Noise Control Engineering of the USA, publishes this quarterly magazine and its Internet supplement. I-INCE has an active program of technical initiatives, which are described in the Internet supplement to NNI. I-INCE currently has fifty-one member societies in forty-six countries.

INCE-USA

The Institute of Noise Control Engineering of the USA (INCE-USA) is a non-profit professional organization incorporated in Washington, D.C., USA. The primary purpose of the Institute is to promote engineering solutions to environmental noise problems. INCE-USA publishes the technical journal, *Noise Control Engineering Journal*, and, with I-INCE publishes this quarterly magazine and its Internet supplement. INCE-USA sponsors the NOISE-CON series of national conferences on noise control engineering and the INTER-NOISE Congress when it is held in North America. INCE-USA Members are professionals in the field of noise control engineering, and many offer consulting services in noise control. Any persons interested in noise control may become an Associate of INCE-USA and receive both this magazine and *Noise Control Engineering Journal*.

NNI and Its Internet Supplement

www.noisenewsinternational.net

The primary change in this PDF-only volume of *NNI* is the ability to have "hot links" to references, articles, abstracts, advertisers, and other sources of additional information. In some cases, the full URL will be given in the text. In other cases, a light blue highlight of the text will indicate the presence of a link. At the end of each feature or department, a light blue back to toc will take the reader back to the table of contents of the issue.

The Internet supplement contains additional information that will be of interest to readers of *NNI*. This includes:

- The current issue of *NNI* available for free download
- *NNI* archives in PDF format beginning in 1993
- A searchable PDF of annual index pages
- A PDF of the current *NNI* conference calendar and a link to conference calendars for worldwide meetings
- Links to I-INCE technical activities and I-INCE Technical Reports

Editor's View

I am writing this article while there is international turmoil over the most recent immigration restrictions mandated by the new US president. Don't worry—I am not going to praise or condemn this action. My point is that it highlights the importance of international communication, travel, and cooperation. Like so many fields, noise control is truly international, with work being done across borders around the world. If one goes back to 1974, at the start of the International Institute of Noise Control Engineering (I-INCE) and the Institute of Noise Control Engineering of the United States (INCE-USA), there was a lot of focus on national noise control programs and regulations. It is quite impressive to see how extensive global programs in noise control have become.

With the NOISE-CON conference in June and the INTER-NOISE conference in August, there will be participation from around the world. While journalists cite the rise of nationalism in political parties and political rhetoric in various countries, it is important that noise control engineers continue to work cooperatively across national borders. In the last week, I have worked with or interacted technically with colleagues from the US, France, Germany, China, Japan, and Korea. This was not a special week—it is typical. This is the nature of noise control and the global community in which we all live.

It is important that we, the noise control community, recognize and support the international nature of our profession. To say it is a strength of our field may seem obvious or mundane to mention, but it is not. We cannot take global cooperation and technical interaction across political borders for granted. We cannot all attend every international conference—there are already too many conferences for many of us. However, we can support our colleagues and students who do. The I-INCE Young Professionals program and similar student support programs from INCE-USA go a long way in getting the newest members of our industry involved professionally, and in many instances helping them to travel internationally. Every one of us needs to support these programs, for they make the way for continued international cooperation and the exchange of technical information without regard to political borders.

Maybe it seems obvious, but global cooperation and communication is crucial to noise control and many other technical fields of work. Please don't take for granted—and look for opportunities to support and facilitate—international conferences, journals, and other means of cooperation and communication. These activities are important to all in the profession and the future of noise control. I am sure none of us want to go back to the early days where every hamlet and municipality had its own noise regulations or ordinances, and no one knew what was going on in noise control across the next political border.

This recent immigration crisis is a good reminder of the cooperation and communication we take for granted and need to preserve.

Jim Thompson, PhD, PE, INCE Bd. Cert
nnieditor@inceusa.org

Noise Control

Improving the Quality of Life

NOISE-CON 2017

June 12–14, 2017

Grand Rapids, Michigan

DeVoss Place Convention Center

The Institute of Noise Control Engineering (INCE-USA) and our NOISE-CON 2017 Committee, invite you to attend NOISE-CON 2017 in Grand Rapids, Michigan. NOISE-CON 2017 will be co-located with the SAE2017 Noise and Vibration Conference and Exhibition. The program is robust and plenary speakers are experts in the industry.

We hope you will plan to join us in Grand Rapids, a great city. I am sure you will find the conference venues and the City of Grand Rapids very comfortable and accommodating.

Conference Chair: James K. Thompson | JKTprof@outlook.com

Conference Vice Chair: Hether Fedullo | Hlee1@ford.com | Ford Motor Co.

Technical Co-Chairs:
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Student Volunteer Coordinator: Dana Lodico | dlodico@illingworthrodkin.com
Illingworth & Rodkin

Special Interest during NOISE-CON 2017:

Joint Technical Sessions — A major feature of the two conferences will be special Joint Sessions to which attendees from both conferences will be invited to attend. These sessions will be of premier quality and share new perspectives, topics, or collaborations based on interactions between INCE-USA and SAE.

- **INCE-USA Technical Sessions** — Over 76 other categories of papers
- **Exposition** — A combined Exhibition center with both NOISE-CON and SAE Exhibitors participating
- **A Social Evening** — Save Tuesday evening for the INCE-USA social event (details to follow)
- **Accompanying Persons Program** — Breakfasts, a garden tour and various other opportunities
- **Student and Young Professional** — Programs including breakfast, workshops, mentoring and more
- **Women in Noise Control Engineering** — Breakfast, networking opportunity

Take advantage of all that is available in Grand Rapids:
http://www.experiencegr.com/

Discounted early registration rate ends April 30, 2017	Until 4/30/17	5/1/17 and after
Members	$695	$795
Non-Members	$795	$895
Student Rate*	$ 50	$ 50

Accompanying Persons $150

To Attend and Receive the Proceedings of **BOTH** *NOISE-CON 2017* **AND** *The SAE NOISE & VIBRATION CONFERENCE* there is an **Additional Fee of $150**

No Charge for Student Volunteers—Contact* **ibo@inceusa.org

Registration Now Open

GO TO:
http://noisecon17.inceusa.org/registration/

Hotel Information

Amway Grand Plaza | 187 Monroe Avenue, NW
Grand Rapids, Michigan 49503 |
www.amwaygrand.com

Room Rate: $150.00 + taxes
Room Block Expires: May 20, 2017

For Hotel Reservations Visit:
https://aws.passkey.com/event/15942631/owner/2529966/home?utm_campaign=87583163

Important Dates

Abstracts due NOW | Papers due by: March 31, 2017

INCE USA

SAE INTERNATIONAL

In Conjunction with SAE

Noise Control
Improving the Quality of Life

NOISE-CON 2017

Joint Technical Sessions

A major feature of the two conferences will be special Joint Sessions to which attendees from both conferences will be invited to attend. These sessions will be of premier quality and share new perspectives, topics, or collaborations based on interactions between INCE-USA and SAE.

The foundation of these sessions will be invited papers given by distinguished presenters. The inclusion of panel discussions is planned for most sessions, providing unique opportunities for interaction with technical leaders across a wide range of industries.

Papers from these sessions will be included in the proceedings from both conferences.

Feel Free to Contact the Technical Chairs with Additional Questions

The Following Topics are being Offered as a Joint Session:

Lightweight Vehicle Construction Acoustic Design
Organizers: Alan Parrett, Gordon Ebbitt, Yukel Gur, Jian Pan, Saeed Siavoshani, Pari Tathavadekar, Barry Wyerman

Artificially Generated Noise in Vehicle Interiors & Sound Quality Considerations
Organizers: Jeff Orzechowski, Gordon Ebbitt

Product Development Methods: Cross-Disciplinary Tools & Processes for Delivering NVH Attribute
Organizers: Hether Fedullo, Taner Onsay, Pari Tathavadekar

Aerodynamic Noise Prediction & Validation
Organizers: Bob Powell, Paul Bremner, Luc Mongeau, Christopher Shaw, Sivapalan Senthooran, Karl Washburn

Hybrid/Electric & Electric Vehicles—Consequences of Minimum Sound Regulatory Requirements
Organizers: Doug Moore, Heather Konet, Paul Donavan, Kiran Govindswamy

Impact of Recreational Noise Source on the Surrounding Communities
Organizers: Hether Fedullo, Jim Dopirak

Aircraft Interior Noise
Organizers: Todd Rook, John Maxon, Mark Moeller, Pascale Neple, Martin Wandel, Andrew Wareing

Technical Sessions

1.0 Commercial & Consumer Products: General Topics
1.1 IT Product Noise
1.2 Commercial *(non-Consumer Product)* Noise
1.3 Construction Power Tools & Equipment
1.4 Benefits for Future Vision of Educated Consumer in Terms of Noise
2.0 Transportation Noise: General Topics
2.1 Highway & Rail Noise Measurement Practices
2.2 Combined Ground Transportation Studies
2.3 Rail Noise & Vibration
2.4 Aircraft Source Noise Modeling
2.5 UAS/UAV Noise
2.7 Aircraft Noise Measurement
2.8 Airport Noise Modeling
2.9 Airport Noise Policy & Outreach
2.10 Transportation Noise in National Parks
2.11 Noise of Surface Ships
3.0 Sources & Propagation: General
3.1 Outdoor Sound Propagation
3.2 Operational & Environmental Inputs to Outdoor Noise Propagation Models
3.2 Tire Noise & Quieter Pavement
3.3 Automobile Noise: Inside/Outside
4.0 Passive Noise Control: General Topics
4.1 Noise Control Materials
4.2 Control of Product Noise with Enclosures
4.3 Large Silencers
5.0 Active Noise & Vibration Control: General Topics
5.1 Active Control of Exhaust Noise
5.2 Vehicle Active Noise Control
6.0 Structural Acoustics: General Topics
6.1 Passive Damping
6.2 Structural-Acoustic Design Optimization
6.3 Techniques for Reducing Sound Transmission & Radiation
7.0 Noise & Vibration Control in Buildings: General Topics
7.1 Architectural Noise & Vibration Control
7.2 Building Acoustics Measurement & Modeling
7.3 HVAC & Building Systems Noise Control
7.4 Mixed Use, Hospitality, & Entertainment
7.5 Sound Masking
7.6 Building Envelope Sound Isolation
7.7 Architectural Acoustics Vendor Presentations
8.0 Community Noise: General Topics
8.1 Appropriate Metrics for Environmental Noise Assessment & Regulation
8.2 Innovative Approaches to Environmental Noise Mapping
8.3 Evaluating Effects of Noise on Communities
8.4 Construction Noise
8.5 Commercial Spacecraft & Launch Noise
8.6 Wind Turbine Propagation Modeling—Community Impacts
9.0 Industrial Noise: General Topics
9.1 Pressure Pulsation Noise
9.2 Using 3-D Printing in Acoustics & Noise Control
9.3 Noise Controls in Mining
9.4 Field Data Acquisition
9.5 Diesel Equipment Noise
9.6 Data Center & Power Plant Noise
9.7 Industrial Equipment Noise
10.0 Subjective Response & Impact of Noise on Health
10.1 Perceptions Based Engineering
10.2 Hearing Loss Prevention
11.1 Acoustics & Noise Measurements
11.2 Fan Noise
11.3 Raytracing Methods
11.4 Modeling Methods
11.7 Modeling of Vibro-Acoustic Systems
12.0 Acoustics & Noise Measurements: General Topics
12.1 Measurements & Signal Processing in Noise Control
13.0 Standards, Policies, Legislation, & Regulations
13.1 Regulations & Directives Effect on Product Noise Control
14.0 Education & Public Outreach
14.1 Classic Papers in Noise Control
15.0 Wind Turbine Noise: General Topics
15.1 Case Studies
15.2 Infrasound & Low Frequency
15.3 Hot Topics in Michigan
16.0 Aeroacoustics: General Topics
16.1 Industrial Noise Tools
16.2 Vacuum Pumps & Blowers
16.3 Flow-Induced Noise & Vibration
17.0 Special Memorial Session—Leo Beranek
19.0 Automotive Noise & Vibration Session

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703.234.4073 | E-mail: ibo@inceusa.org | www.inceusa.org

The Belgian Acoustical Association (ABAV)

The **Belgian Acoustical Society (ABAV)** was founded in 1966 as a national society without the goal of making a profit. The society gathers all interested persons from universities, research laboratories, consulting offices, industry, governmental organizations . . . with activities in the field of acoustics in its broadest sense: physical acoustics, industrial noise control, building acoustics, environmental protection, electroacoustics, noise protection, etc. A list of past and future activities can be found on the society's website: http://www.abav.be.

The ABAV board is composed of twelve active members: Dick Botteldooren (president), Dominique Pleeck (vice president), F. Verbandt (vice president), Debby Wuyts (secretary general), Peter Houtave (treasurer), Lieven De Geetere, Fabienne Duthoit, Bart Ingelaere, Jean Némerlin, Monika Rychtarikova, Jean-Jacques Embrechts, and Jean-Pierre Clairbois. So far, the board also counts five honorary presidents: Georges Pleeck (†), Andre Cops, Pierre Chapelle (†), Daniel Soubrier, and Gerrit Vermeir.

The society currently has 150 members (effective, associate, student, and honorary) and 66 supporting members.

The ABAV Society has the following goals:

- to create a permanent working frame for information exchange between members emanating from any of the acoustical disciplines;
- to collect, to exchange, and to disseminate information on all acoustics-related topics of concern for the society;
- to create a forum for discussion and exchange about noise management, noise protection, and noise control in the interest of creating an acceptable and sustainable acoustical environment;
- to contribute to the development and promotion of acoustics as a scientific discipline;
- to establish strong links with similar national and international associations.

Within the ABAV, the nonprofit initiative **Belgian Young Acousticians Network** (B-YAN) was founded in 2013. Their primary goal is to establish a community for young researchers and young professionals in the field of acoustics—to connect them and to provide support. Today, the network consists of approximately 25 members and is addressed to any young acoustician (under 40 years old) in Belgium, including engineers, consultants, students, and researchers.

The Belgian Acoustical Association has been a member of **International Institute for Noise Control Engineering** (I-INCE) since 1979 and organized, in collaboration with the Royal Flemish Society of Engineers, the 22nd International Conference on Noise Control Engineering ("People versus Noise") in Leuven in 1993 (INTER-NOISE '93).

The Belgian Acoustical Association was one of the founding members of the **European Acoustical Association** (EAA) in 1993 and organized the first EAA Forum Acusticum in Antwerp in 1996. The Belgian Acoustical Association also collaborated with the Société Française d'Acoustique (SFA) for the successful organization of the 6th CFA (Congrès Français d'Acoustique) in 2002 at Lille, France. ABAV also organized the EuroNoise 2015 conference in Maastricht together with the Dutch Acoustical Society (NAG).

For further information on the activities of the Belgian Acoustical Association, contact Debby Wuyts (secretary) or Dick Botteldooren (president), Belgian Building Research Institute (BBRI), Avenue Pierre Holoffe 21, B-1342 Limelette, Belgium.

Tel: +32 2 655 77 11,
e-mail: debby.wuyts@bbri.be
Online: http://www.abav.be

inter.noise
27-30 AUGUST HONG KONG 2017

46th International Congress and Exposition on Noise Control Engineering

www.internoise2017.org

Organizers:

In conjunction with:

NVH Committee of SAE-China

Important Dates

Abstract Submission Period:	January 1 to March 31, 2017
Notification of Acceptance of Abstract*:	April 2017
Paper Submission Deadline:	May 31, 2017 (May 1, 2017, if opting for peer assessment)
Early Bird Registration Deadline:	April 28, 2017

** Participants requiring the formal acceptance of abstract to progress their approval to attend should submit abstracts early as the issue of notifications of acceptance of abstracts will occur in stages during the abstract submission period.*

Remarks: Deadline will not be extended.

An Invitation to INTER-NOISE 2017

The Hong Kong Institute of Acoustics and the Hong Kong Polytechnic University warmly invite you to attend the 46th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2017). The Congress is organized in conjunction with the Acoustical Society of China and the NVH Committee of the Society of Automotive Engineering, China. It will be held in Hong Kong from August 27 to 30, 2017, at the Hong Kong Convention and Exhibition Centre (HKCEC).

INTER-NOISE 2017 will provide the best opportunity for engineers and scientists in all fields of acoustics to learn about and share their work with colleagues from around the world. Five keynote speeches and more than a hundred technical sessions will be arranged for exchanging views and sharing experiences.

Congress Theme—Taming Noise and Moving Quiet

More and more people are living in cities nowadays. As the population density increases, the noise issue has become increasingly important in affecting the living quality of citizens. Noise in urbanized cities mostly comes from human beings, transportation, construction, buildings, and city services, which are all essential for the progress of city development. Taming these noises is therefore a very challenging task for governments, professionals, and academia. Efforts to keep moving vehicles quiet during operation is of prime importance to the benefit of citizens.

Technical Program

A broad variety of technical sessions are grouped into the following themes and led by international experts.

- Acoustic Signal Processing
- Acoustics Materials
- Active Control of Sound and Vibration
- Aircraft Noise
- Architectural Acoustics/Building Acoustics
- Education
- Environmental Noise
- Flow Induced Noise and Vibration
- Industrial Noise
- Noise and Health
- Product Noise and Sound Quality
- Pyschoacoustics
- Soundscape and Noise Management
- Speech and Communication
- Tire/Road Noise
- Transportation Vehicle Noise and Vibration
- Underwater and Maritime Noise
- Vehicle Noise Vibration and Harshness (NVH)
- Vibro-acoustics

Categories	Early Bird Registration (on or before April 28)	Standard Registration (April 29–August 20)	Onsite Registration (After August 20)
Full Delegate	USD 720	USD 800	USD 880
Student	USD 200	USD 250	USD 250
Accompanying Person	USD 130 per person		
Additional Paper	USD 180 per paper		
Congress Banquet	USD 110 per person		

Deadline for abstract submission: March 31, 2017

Congress Registration

Registration can be done via the INTER-NOISE 2017 online registration system at www.internoise2017.org.

Sponsorship and Exhibition Opportunities

The Congress provides you with an unrivaled opportunity to connect directly with a significant group of world leading engineers and experts. There are a number of ways for you to be involved in the exhibition, giving you the opportunity to network and raise your profile within the industry. Packages can be tailored to help achieve specific objectives and can be found on the Congress website at www.internoise2017.org.

About Hong Kong

Hong Kong is recognized as the home of an enormous number of Chinese and internationally affiliated professional associations, making it the perfect choice for knowledge sharing and the ideal convention destination. Hong Kong's strategic location, close to the world's

fastest growing economies, provides an ideal platform for international organizations and professional bodies to work with mainland China and other Asian counterparts. Even the biggest conventions are at home in Hong Kong. More than 57,000 hotel rooms—from super deluxe hotels to approved budget hostels—are available to suit every need, taste, and budget. Small- and medium-sized groups can also find world-class accommodation to meet their needs.

No conference is complete without experiencing some of the more spectacular entertainment programs, diverse shopping opportunities, and great food that Hong Kong offers. A wide selection of tours, ranging from sightseeing harbor cruises to a heritage tour, are also available for delegates to join before and after meetings. Situated on the doorstep of Southern China, Hong Kong is also a stone's throw from a variety of exciting mainland cities, including the burgeoning metropolis of Shenzhen and the provincial capital, Guangzhou. A convenient visa system allows foreign visitors in Hong Kong to

visit Guangdong Province for a maximum of six days (144 hours).

The Congress venue is at the Hong Kong Convention and Exhibition Centre (HKCEC). The Centre is one of the largest multi-use venues in Asia and continues to be a globally recognized landmark complementing Hong Kong's cityscape. The opening and closing ceremonies, keynote speeches, and the plenary and award presentation will be held in Convention Hall. Registration, cocktail parties, and social buffet will be in the

Convention Foyer. Nineteen meeting rooms of various sizes to accommodate 20 to 300 people will be reserved for structured parallel technical sessions of the Congress.

Hong Kong has a liberal visa policy, allowing visa-free entry to nationals of more than 170 countries and territories. You can find the immigration information from the Hong Kong Immigration Department website at www.immd.gov.hk.

For the most up-to-date tourist information, please visit the Hong Kong Tourism Board website at www.discoverhongkong.com.

For enquiry, please contact:

General and Registration: conf.secretary@internoise2017.org
Sponsorship: sponsorship@internoise2017.org
Exhibition: exhibition@internoise2017.org

INTER-NOISE 2017 Congress Secretariat
c/o International Conference Consultants Ltd.
Office Address: Unit C-D, 17/F, Max Share Centre, 373 King's Road, North Point, Hong Kong
Tel: (852) 2559 9973
Fax: (852) 2547 9528

Upcoming INCE Awards and Honors for 2017

INCE Members, Associates and Friends,

For 2017, the Institute of Noise Control Engineering (INCE) and the INCE Foundation are accepting nominations for two major awards:

- the INCE Excellence in Noise Control Engineering Award
- the Martin Hirschorn IAC Prize—Student Project Award

Both of the awards will be presented at the upcoming NOISE-CON 2017 meeting in Grand Rapids, MI, in June 2017. A brief summary for each of the awards, including submission/nomination deadlines, is provided below.

To receive an application for an Excellence in Noise Control Engineering Award nomination and/or the Hirschorn IAC Prize Student Paper Award nomination, please send a request to:

Jeffrey L. Fullerton, INCE Bd. Cert.,
LEED AP INCE Vice President, Honors & Awards Acentech
33 Moulton Street
Cambridge, MA 02138
617-499-8058
E-mail: vp_awards@inceusa.org

For more information about the INCE USA Awards program, including a complete list of past awardees, please see the Awards page at the INCE USA website: http://www.inceusa.org/about-ince-usa/honors-and-awards/.

INCE Excellence in Noise Control Engineering Award Engraved Memento and Honorarium of $3,000 Nomination Deadline: February 21, 2017

The INCE Excellence in Noise Control Engineering Award is intended to provide, and disseminate widely, recognition for an outstanding project, product, or processes in the applied practice of noise control engineering. The project, product or process should demonstrate a significant contribution toward a quieter environment. The precise nature of the project, process, or product is not rigorously defined by policy but is left to the nominator to establish and the judges to evaluate. Some examples of possible nominees may include, but are not limited to the following:

- Innovative consumer or industrial products developed specifically for the purpose of noise control or noise reduction
- Improvements to existing consumer or industrial projects to significantly reduce noise levels or noise exposure
- Development of new or improved techniques, materials or products for noise control, for buildings and construction
- Development or improvement of noise policy, guidance or standards resulting in greater or more consistent noise control engineering application or practice
- New or innovative techniques used in noise assessment or control for large transportation, energy or industrial projects, including environmental studies, design or construction projects
- Development or improvements of tools, equipment, processes, practices, computer programs and applications for use in noise analysis and control

Nominations may be developed to recognize an individual or group of individuals for closely related contributions which, in the opinion of the nominator, constitute collectively a significant specific contribution to noise control engineering. The award shall consist of an engraved plaque and an Honorarium of $3,000. A suitable nomination package for this award is not trivial and will require some time to prepare, so please request the nominating instructions at least one month before the submission deadline. There will be no extension of the submission deadline.

Martin Hirschorn IAC Prize—Student Award Award amount: $4,000 cash prize Submission Deadline: March 6, 2017

The award is granted as a contribution to the education of a graduate student studying noise control engineering in the United States of America who proposes a project related to an application of noise control engineering and/or acoustical conditioning of architectural spaces. An application must be received for each candidate wishing to be considered for this award which shall contain detailed information about the student and the proposed project including a commitment to publish the results of the project in a form suitable for the *Noise Control Engineering Journal*.

International News

ICA 2016 Buenos Aires

The International Commission for Acoustics (ICA) provides support for a number of specialist meetings and symposia each year, but the major event bringing together those working in all areas of acoustics is the congress held every third year. The geographical region given the opportunity to host the event is selected by the board eight years in advance, and the bids from the member organizations in that region are presented six years in advance. So, in 2010, the opportunity was given to the Ibero-American Federation of Acoustics to host the International Congress on Acoustics from September 5 to 9, 2016, (ICA 2016) in Buenos Aires, Argentina, which endorsed the local organization to the Argentinian Acoustical Association.

It was considered important to take the event to the region where there is enthusiasm and growing expertise in a range of areas of acoustics. This is the first time that the major international congress on acoustics has been held in South America, and only the third time that it has been held in the Southern Hemisphere (the previous times being in Sydney, Australia, in 1980 and 2010). The total number of participants was over 800, and over 600 papers were presented. While the total numbers were less than those for a congress in Europe or the North Americas, the enthusiasm of the participants was a key mark of the Congress. All the sessions had good attendances, the morning and afternoon tea areas were crowded every day with active discussions, and many continued after the last presentation each day. What was also refreshing was that the closing ceremony on day five of the Congress was attended by almost as many participants as the opening on day one. The proceedings are freely available from the ICA website at http://www.icacommission.org/proceedg.html, and views from the Congress are available from http://ica2016.org.ar.

It is particularly notable that while the ICA usually has a high proportion of students, ICA 2016 saw that students made up around 40 percent of the participants, reflecting the value of holding this event in the growing area of South America. The ICA has a tradition of providing "Young Scientist Congress Attendance Grants." From its resources, the ICA awarded 34 such grants, which were selected from 66 applications. These were distributed as follows: USA (6), Brazil (5), UK (5), France (4), Australia (2), Canada (2), Korea (2), plus 1 each from Argentina, Chile, Denmark, Finland, Israel, Poland, Russia, and Sweden. The support from the IUPAP for this Congress was very much appreciated as it allowed for more Young Scientist Congress Attendance Grants that were for applications from Latin America. A total of 51 IUPAP attendance grants were awarded, 12 of which were for those who had just graduated and the remainder for those still in school. The distribution was: Argentina (19), Chile (12), Brazil (11), Peru (3), Bolivia (2), Uruguay (2), Spain (1), and Venezuela (1).

The prestigious ICA Early Career Award is presented at the time of the congress, and for ICA 2016 the recipient was Professor Frank Russo from Ryerson University, Canada. The citation is "*For outstanding contributions to psychological acoustics, particularly the theory of musical cognition and perception.*" Frank is indeed a worthy recipient of this award. In addition to his outstanding research achievements, he has contributed substantially to the activities and management of the Canadian Acoustical Association. He presented a fascinating plenary lecture on "Understanding Music Perception from the Perspective of Oscillation and Resonance," which was accompanied by audio demonstrations and that clearly showed the application of physics to the study of perception of sound.

The other plenary lectures were: Michael Vorländer (Germany), on "From Acoustic Simulation to Virtual Auditory Displays"; Chen-Fen Huang (China), on "The Perspective of Underwater Acoustic Tomography for Probing Ocean Currents in Shallow-Water Environments"; Barbara Shinn-Cunningham (USA), on "How the Brain Makes Sense of Complex Auditory Scenes"; and Samir Gerges (Brazil), on "Hearing Protectors: State of the Art and Emerging Technologies of Comfort and Uncertainty in Measurements."

Jorge Patricio (Portugal) and Nilda Vechiatti (Argentina), plus their committee, were sincerely thanked for their substantial efforts for organizing this Congress. The value of participation in an ICA was recognized, and we left Buenos Aires with enthusiasm for the next ICA in Aachen, Germany, to be hosted by German Acoustical Society (DEGA) and held September 8–13, 2019, in what we hope will be declared the International Year of Sound.

Marion Burgess, Past President ICA

International Noise Awareness Day – April 26, 2017

The International Noise Awareness Day (INAD) was founded in 1996 by the Center of Hearing and Communication (CHC), and since then the day is commemorated annually on the last Wednesday in April. The International Noise Awareness Day (INAD) aims at raising awareness of noise on the welfare and health of people worldwide.

The European Acoustics Association (EAA) participates in the celebration every year by a series of events addressed to the whole society, with special emphasis to young people who are among the most sensitive persons of our society. These events have typically been organized so far by the EAA member societies.

For 2017, the EAA decided to coordinate a wider campaign in order to raise the interest of European citizens toward noise and its effects on the quality of life and health (the INAD 2017). EAA will collaborate with the European Commission (in particular the DG Environment) and the European Environment Agency to promote and coordinate specialized activities during the year. Targeted audiences include the EAA member societies, the European and national authorities, the noise associations, and schools, museums, etc., so that a wider public will receive the most accurate and scientifically correct information on noise effects.

EAA has also prepared a special web page (https://euracoustics.org/INAD2017/index.html) with the aim to collect and disseminate all the information on the activities coordinated by EAA and organized either centrally by EAA or by the member societies and other related organizations.

In the United States, the Center for Hearing and Communication coordinates events. Their website, http://chchearing.org/noise/day/, has information on this topic as well.

International Year of Sound

The board of the International Commission for Acoustics (ICA) is working toward the declaration of an **International Year of Sound in 2019** (IYS 2019) and is grateful for the support and encouragement thus far from the I-INCE.

Sound is an all-encompassing aspect of life, and an international year with a focus on sound provides tremendous scope to improve the understanding of the underlying physics principles, as well as the applications in science, technology, engineering, and the role of sound in the life of the people. The ICA believes that the International Year of Sound follows on well from the International Year of Light (2015), which is considered to be one of the most successful International Years. The ICA has received enthusiastic support from a wide range of organizations involved with various aspects of physical and social sciences, as well as from institutions related to health, culture, sociology, and education.

Sound is an integral part of culture and society, from the basic requirements for communication, awareness of our environment, and expression of our culture to sophisticated scientific and technological instruments. The proper use and feeling of sound is essential for the quality of life. In this respect, the control of unwanted sound is important for the future health and well-being of those that comprise our society.

The International Year of Sound will enable coordination of international and national activities to achieve the following goals:

- Improve the public understanding of the wide application of sound in our daily life.
- Promote the relevance of sound to music and culture.
- Identify and maintain soundscapes (the sound that is part of different environments) as part of cultural heritage.
- Highlight the importance of the use and benefits of sound while controlling the unwanted noise.
- Raise understanding of those in society with hearing or speech impairment.
- Promote the importance of protecting hearing, especially in the workplace and in recreational activities.
- Promote the important role that sound plays in medicine and the improvement that brings to the health of the community.
- Raise the knowledge of the applications and impact of sound underwater.
- Increase worldwide education with activities targeted on science and technology for young people.
- Enhance international cooperation between learned societies, educational establishments, and industry.
- Maintain these goals and achievements into the future beyond the International Year of Sound.

These activities will aim to stimulate the understanding and awareness throughout the world of the important role that the physical concept of sound plays in all aspects of our society. The declaration of an International Year of Sound in 2019 will provide a focus that will encourage transfer of knowledge on creating, controlling, hearing, and using sound in nature, in the built environment, and in all aspects of our life. The ICA committee, which was formed with the purpose to achieve the declaration of the IYS 2019, is in contact with UNESCO and expects the important decisions to be made in 2017.

Michael Taroudakis, President ICA, and Marion Burgess, Past President ICA

World Hearing Day

World Hearing Day: March 3

World Hearing Day is an annual advocacy event held on March 3. Designated at the First International Conference on Prevention and Rehabilitation of Hearing Impairment in Beijing, China, in 2007, the day aims to raise awareness and promote ear and hearing care across the world.

If you would like to receive updates and information about World Hearing Day, you can register by sending an email to whopbd@who.int.

World Hearing Day 2017

The theme for the World Hearing Day 2017 is "Action for Hearing Loss: Make a Sound Investment." This aims to draw attention to the economic impact of hearing loss and cost effectiveness of interventions to address it.

For more information, you can go to http://www.who.int/pbd/deafness/world-hearing-day/en/.

Embargoed for March 3rd 2017, World Hearing Day

mimi sounds like you

Worldwide Hearing Index 2017

Report suggests link between hearing loss and noise pollution in cities

- Study from the largest ongoing global digital database regarding hearing loss, with over 200,000 participants
- Residents of Vienna, Austria, have the least amount of hearing loss proportionate to their age, while citizens of Delhi, India, have the most
- Zurich, Switzerland, has the least incidence of noise pollution, and Guangzhou, China, has the highest
- Noise pollution in cities and hearing loss were found to have a 64% positive correlation
- The full results of the study can be found here: http://www.mimi.io/hearingindex

Berlin, Germany, March 3rd 2017 – For World Hearing Day, digital hearing app Mimi has published a report detailing hearing loss around the world. Using data gathered from over 200,000 participants of their hearing test, statistics from the World Health Organization, and the SINTEF report on noise pollution, the study investigates how noise pollution in cities relates to hearing. The company hopes that the data will not only provide a unique insight into the current state of global hearing loss, but will also act as a call to action for individuals and health care providers to make better investments concerning aural health.

Dr. Manfred Gross from Charité University Hospital, Berlin, said: "While eye and sight

checks are routine for most, ear and hearing exams are not. This is an issue as the earlier hearing loss is detected, the better the chances are for preventing further damage."

To conduct the report, data was gathered from the Mimi hearing test app, which allows participants to enter their age and gender, and then test their hearing. The Worldwide Hearing Index presents the average difference between a participant's true age and their hearing age in each location.*

The Average Hearing Loss Index was found to have a 64% positive correlation with Noise Pollution levels in each city, indicating hearing loss may be an outcome of living in these cities. The results of the Hearing Loss Index of each city and the Noise Pollution were mapped to range between 0 and 1. The sum of these two rankings were combined to give an overall Combined Hearing Loss Rank.

For the full methodology see the base of the press release and the study results page.

Residents of *|City|*, *|Country|* were found to have an average additional hearing age of *|Average|* years, placing in position *|mimi rank|* out of the 50 cities included. This can be further broken down by sexes, with males found to have an average hearing age of *|Male|* years and females *|Female|* years. When combined with the rank of Noise Pollution, *|City|* ranked *|Overall|* out of the 50 cities included. It is this factor which ranks the tables above.

Findings of interest from the report include:

- Residents of Vienna, Austria, were found to have the smallest Average Hearing Loss, meaning they suffered the least amount of hearing loss proportionate to their age.
- Residents of Delhi, India, were found to have the greatest Average Hearing Loss within the study, meaning they suffered the most amount of hearing loss proportionate to their age.

The findings from the Mimi app are in agreement with current research in this area, which expects the average person to have a hearing loss of +10–20 years.

The full results of the study are represented in figure 1. Noise Pollution is plotted against Hearing Loss in order to visually demonstrate the positive correlation between the two factors.

"With the Worldwide Hearing Index, we are aiming to create visibility and highlight the importance of good hearing and hearing health. Hearing is one of our most important senses, but has no lobby and little awareness so far. Smartphone technologies nowadays makes it easy to take a first step, test your hearing and get informed about one's hearing health," adds Dr. Henrik Matthies, Managing Director of Mimi Hearing Technologies.

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* The location of the participants in the Mimi Hearing app was determined via their geolocation and all data was anonymized.

* 50 cities with enough available data to form a representative sample were selected.

The 5 cities with the lowest Combined Hearing Loss are:

	City and Country	Male Hearing Loss Index (yrs.)	Female Hearing Loss Index (yrs.)	Average Hearing Loss Index (yrs.)	Hearing Loss Index Ranked	Noise Pollution Ranked	Combined Hearing Loss Rank
1	Zurich, Switzerland	+10.43	+10.82	+10.63	0.02	0.00	0.02
2	Vienna, Austria	+10.53	+10.65	+10.59	0.00	0.07	0.07
3	Oslo, Norway	+11.86	+12.02	+11.94	0.16	0.07	0.23
4	Munich, Germany	+11.81	+12.24	+12.02	0.17	0.07	0.24
5	Stockholm, Sweden	+11.65	+12.08	+11.86	0.15	0.11	0.26

The 5 cities with the highest Combined Hearing Loss are:

	City	Male Hearing Loss Index (yrs.)	Female Hearing Loss Index (yrs.)	Average Hearing Loss Index (yrs.)	Hearing Loss Index Ranked	Noise Pollution Ranked	Combined Hearing Loss Rank
46	Istanbul, Turkey	+17.94	+18.73	+18.33	0.93	0.64	vv1.57
47	Mumbai, India	+18.40	+18.77	+18.58	0.98	0.69	1.67
48	Cairo, Egypt	+18.33	+17.73	+18.03	0.89	0.81	1.70
49	Delhi, India	+19.15	+19.53	+19.34	1.00	0.72	1.72
50	Guangzhou, China	+16.89	+17.98	+17.43	0.82	1.00	1.82

Methodology

The Worldwide Hearing Index focuses on two factors: Hearing Loss (HL), which focuses on how much hearing loss the residents have, disregarding expected loss experienced from natural aging, and noise pollution (NP). The difference between the participants age and their actual hearing age was calculated in regards to the ISO Standard, resulting in the indicator "Hearing Loss" (HL). The

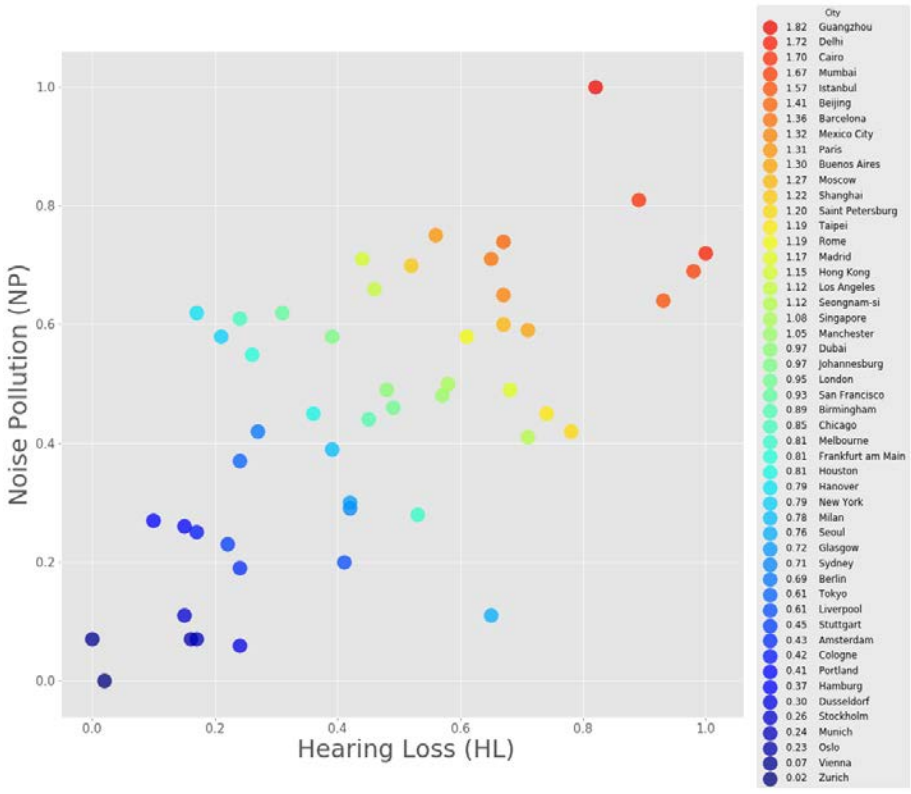

Figure 1. This shows the relationship between the Noise Pollution (NP) and Hearing Loss (HL) indicators. Each city in the ranking is represented by a colored circle mapped to the respective World Hearing Loss Index. This chart suggests that the higher the levels of noise pollution in a city, the higher the incidence of hearing loss.
Source: Mimi. For the high resolution image or questions please send enquiries to ricky@abcd.agency.

data was normalized within the sample for clearer representation into 0–1 (0: min, 1: max). Cities with a greater HL result in the ranking show proportionately worse hearing in relation to the age of the participants. Data was also collected from the World Health Organization and the SINTEF report on Noise Pollution (NP) and is also presented as 0–1 (0: min, 1: max). The data has a 0.64 Pearson's correlation coefficient, meaning that the two factors demonstrate a 64% positive correlation. These two indicators were then added together to show how the aforementioned factors contribute simultaneously, and the study was ranked based on this result. Further explanation of the methodology and a full list of the results can be found on the landing page.

We used data gathered from the digital Mimi hearing test app, which allows participants to enter their age, sex, and to test their hearing age. The hearing age is calculated under the ISO 7029 Standard 1999:2013, Acoustics: Estimation of noise-induced hearing loss, ICS:12.140, (2013). The location of the participants was determined via their geolocation. From this database, we selected 50 cities where enough data was available to form a representative sample; thus, cities without sufficient data were not included in the study.

From the available data, we looked at the Hearing Loss of the user, HL, or, defined as:

$$HL = Hearing\ Age - Age$$

Thus, a negative value of HL, or a small absolute HL but high Hearing Age and Age, implies that the user is presenting hearing loss. This number represents the absolute value of the difference between a user's actual age and their hearing age. Based on this number we ranked these results for both male and female. We calculated the average HL between genders. Based on these results we extrapolated a HL for each of the 50 cities. The data is normalized within the sample by representing the HL of the city from 0–1. (0: min, 1: max).

$$HL_{\ indicator} = \frac{HL_i - HL_{min}}{\left| HL_{max} - HL_{min} \right|}$$

We then collected data from the World Health Organization and SINTEF report on noise pollution and ranked the cities within the samples to form the Noise Pollution indicator (NP). This data was also normalized within the sample by representing the noise pollution of the city from 0–1. (0: min, 1: max).

$$NP_{\ indicator} = \frac{NP_i - NP_{min}}{\left| NP_{max} - NP_{min} \right|}$$

Each city's score on the World Hearing Index is defined as the sum of these two indicators. This value allows us to understand how each city on the index performs in terms of these two factors in comparison to the others on the list.

http://www.sciencedirect.com/science/article/pii/S037859551300035X

About Mimi: The Mimi Hearing Technologies GmbH (https://mimi.io/)

defines the future of sound and redefines the way how people listen and experience music. The in-house developed smartphone based technology by hearing scientist and audio engineers personalizes sound for a more rich and clear listening experience and helps to hear lost frequencies again. Mimi drives innovation in the fields of hearing test software, fitting, and sound processing. In the past years Mimi has tested almost a million ears in over 80 countries with the Mimi Hearing Test and developed the first app which truly personalizes sound to your unique hearing profile with Mimi Music.

Pan-American News

S.A. Hambric

ICA 2016 Held in Buenos Aires

The 22nd International Congress on Acoustics was held in Buenos Aires, Argentina, on September 5–9, 2016. The Congress venue was the Catholic University of Argentina in Buenos Aires (UCA). ICA 2016 was organized by the Ibero-American Federation of Acoustics (FIA) and the Argentinian Acousticians Association (AdAA), in cooperation with the Chilean Acoustics Society (SOCHA), under the endorsement of the International Commission for Acoustics (ICA). The ICA was held jointly with the Ibero-American Federation of Acoustics Congress, incorporating the XIV Argentinean Congress of Acoustics and the XXVI Meeting of the Brazilian Acoustical Society.

The Congress was officially sponsored by the Acoustical Society of America (ASA), the International Union of Pure and Applied Physics (IUPAP), and the National Council of Acoustical Consultants (NCAC). It was also sponsored by several universities and professional institutions of Latin America.

The technical program included plenary and keynote lectures, invited, contributed, and electronic poster papers covering all aspects of acoustics. There was an extensive technical exhibition highlighting the latest advances in acoustical products, such as materials, systems, and equipment. ICA 2016 topics are listed below. The proceeding is available for download at: ica2016.org.ar.

- Acoustical Measurements and Instrumentation
- Acoustical Oceanography
- Animal Bioacoustics
- Architectural Acoustics
- Biomedical Acoustics
- Communication Acoustics
- Education in Acoustics
- Electroacoustics and Audio Engineering
- Environmental Acoustics and Community Noise
- Musical Acoustics
- Noise—Sources and Control
- Numerical Techniques
- Physical Acoustics
- Psychological and Physiological Acoustics
- Signal Processing in Acoustics
- Soundscape
- Speech Communication
- Structural Acoustics and Vibration
- Underwater Acoustics
- Virtual Acoustics

2017 SOBRAC to Be Held in Brasilia, Brazil

The 27th annual SOBRAC meeting will be held May 28–31, 2017, in the federal capital of Brazil—Brasilia. The meeting will be in the Convention Center of the National Confederation of Trade Workers (CNTC), which is centrally located and close to the Parque da Cidade Sarah Kubitschek, the biggest urban park in the region. More details can be found at sobrac2017.com.br.

Acoustics 2017 to Be Held in Boston, MA

The Acoustical Society of America (ASA) and the European Acoustics Association (EAA) invite acousticians from around the world to participate in Acoustics '17 Boston to be held Sunday through Thursday, June 25–29, 2017, in Boston, MA, USA.

A broad range of topics in acoustics will be covered in technical sessions and keynote lectures. Presentations on emerging topics are especially encouraged. Social events, student events, and an accompanying persons program will be organized.

The best features of meetings of both organizations will be combined to offer a premier venue for presenting your work to an international audience.

Boston is the capital of and largest city in Massachusetts, and is one of the oldest cities in the United States. It is located on the Atlantic Coast and is home to many historic sites dating back to the American Revolution, in addition to many other cultural and recreational features. The climate in June is very pleasant and ideal for arranging visits before and after the meeting.

A team of individuals from the EAA and the ASA are working enthusiastically to organize the meeting. We hope you will join us in Boston in 2017 to help us make the meeting a success.

New ASA Fellows

The Acoustical Society of America (ASA) has promoted the following new Fellows:

- Douglas A. Abraham, for advancing our understanding of the statistics of non-Rayleigh reverberation and their impact on target detection and false alarm rates
- Joshua G. Bernstein, for contributions to our understanding of normal and impaired pitch and speech perception
- David Braslau, for lifetime contributions to noise mitigation and quieter communities

- Tim Colonius, for contributions to numerical modeling of cavitation, medical acoustics and aeroacoustics
- Elisa E. Konofagou, for contributions to diagnostic and therapeutic applications of ultrasound
- Ying-Tsong Lin, for contributions to shallow water acoustics and computational acoustics
- Tyrone M. Porter, for contributions to the therapeutic applications of ultrasound

NOISE-CON 2017 to Be Held Jointly with SAE Noise and Vibration Conference in Grand Rapids, MI

The Institute of Noise Control Engineering (INCE-USA) and our NOISE-CON 2017 Committee invite you to attend NOISE-CON 2017 in Grand Rapids, MI, USA. NOISE-CON 2017 will be co-located with the SAE 2017 Noise and Vibration Conference and Exhibition. The program is robust and plenary speakers are experts in the industry. The combined exhibition will be one of the largest ever in North America with over 100 exhibitors expected to attend. With 400 presentations and over 1000 attendees, this will be a major event for noise control professionals. A special set of joint sessions are planned with the following topics:

- Aerodynamic Noise Prediction and Validation
- Aircraft Interior Noise
- Artificially Generated Noise in Vehicle
- Hybrid/Electric and Electric Vehicles—Consequences of Minimum Sound Regulatory Requirements
- Impact of Recreational Noise Source on the Surrounding Communities
- Interiors and Sound Quality Considerations
- Lightweight Vehicle Construction Acoustic Design
- Product Development Methods: Cross-Disciplinary Tools and Processes for Delivering NVH Attribute

For more information, see the detailed description provided separately in this issue or go to http://noisecon17.inceusa.org/.

2nd FLINOVIA Symposium to Be Held at Penn State University

I-INCE is co-sponsoring the 2nd Flow Induced Noise and Vibration, Issues and Aspects (FLINOVIA II) workshop to be held at Penn State University April 27–28, 2017. Invited speakers will present recent work on structural excitation and noise from turbulent flows, including turbulent boundary layers, ingested turbulence, free and impinging jets, and other turbulent shear layers. Structural response, including vibration, stress, and sound re-radiation are of particular interest. Thirty-two talks, half by international researchers, will be presented. The proceedings will be published by Springer after the symposium. The workshop is free to attend, and you may register by following the links at www.cav.psu.edu.

ASME NCAD IMECE Rayleigh Lecture and Tutorial

The ASME Noise Control and Acoustics Division (NCAD) sponsored the annual Rayleigh Lecture and NCAD tutorial at the 2016 ASME International Mechanical Engineering Conference and Exposition (IMECE), held in Phoenix, AZ, in November 2016.

Dr. Vic Sparrow, Chair of the Graduate Program of Acoustics at Penn State University, gave the Rayleigh Lecture on "Two Approaches to Reduce the Noise Impact of Overland Civilian Supersonic Flight." The talk explained sonic boom noise and ongoing work to enable overland supersonic flight for civilian aircraft (currently prohibited in the USA and most countries).

Dr. Miao Yu, Director of the Sensors and Actuators Laboratory of the University of Maryland, gave the tutorial on Acoustic Sensing Technologies. The tutorial describes research on using emerging materials and bio-inspiration to create new acoustic sensing concepts and technologies.

The lecture and tutorial are available for free download at the ASME NCAD website: https://community.asme.org/noise_control_acoustics_division/default.aspx.

ASME Per Bruel Gold Medal Awarded to Patricia Davies

The Per Bruel Gold Medal for Noise Control and Acoustics was established in 1987 in honor of Dr. Per Bruel, who pioneered the development of sophisticated noise and vibration measuring and processing equipment. The medal recognizes eminent achievement and extraordinary merit in the field of noise control and acoustics, including useful applications of the principles of noise control and acoustics to the art and science of mechanical engineering.

The 2016 Per Bruel Gold Medal was awarded to Patricia Davies, PhD, professor of mechanical engineering, and director, Ray W. Herrick Laboratories, Purdue University (West Lafayette, IN), for exceptional leadership and educational mentorship in the field of noise control and acoustics; and for outstanding contributions to noise control engineering in the areas of signal processing, nonlinear dynamic modeling, product sound quality,

and human response to noise and vibration.

Acoustics Week in Canada 2017 in Guelph, Ontario

Acoustics Week in Canada 2017 (AWC17) will be held October 11–13, 2017, at the Delta Hotel and Conference Centre Guelph (Ontario). Three days of keynote talks and technical sessions will be framed by events such as the welcome reception, conference banquet, and an exhibition of products and services relating to the field of acoustics and vibration. Features of special interest connected with this conference are:

- Octoberfest celebrations; and
- A building code changes and tools workshop by the Canadian National Research Council

Acoustics Week details are available at http://awc.caa-aca.ca/index.php/AWC/awc17.

Asia-Pacific News

Australia and New Zealand

The second joint Acoustical Society of New Zealand and Australian Acoustical Society conference, "Acoustics 2016," was held in November 2016 in Brisbane, Queensland. Aside from the pleasant venue and convenient, picturesque location, it was a lively atmosphere of over 70 technical exhibitors and was particularly well attended with participants from both countries. Five parallel sessions were held over the three days, covering topics including architectural acoustics, environmental noise and vibration, marine bioacoustics, acoustical practice and analysis, and aeroacoustics. As usual with conferences in our region, the bringing together of acousticians, many of whom have travelled great distances, it is not only the technical discussions but the social aspects that are important to the success of the conference. The 2016 joint conference provided well for this with an opening and closing reception, plus a most enjoyable conference dinner on the Thursday evening, with comical and insightful speeches and award presentations.

This conference set a high standard and there is already some planning for the next joint event. However, for 2017, the national Australian Acoustical Society Conference will be held November 19–22 in Perth, Western Australia.

Korea

The Korean Society for Noise and Vibration Engineering (KSNVE)

Spring/Autumn 2016 Conferences

Over 1,000 researchers attended the spring/autumn 2016 conferences organized by the Korean Society for Noise and Vibration Engineering (KSNVE). Over 450 papers were presented, and 60 exhibition booths were installed during the meetings. Spring conference 2016 was held on April 20–23, 2016, at The-K Hotel Gyeong Ju, Korea. Main contents were: Invited Special Lecture, Reception Lecture, Liberal Lecture, Award Lecture, 238 papers, and 33 exhibition booths. Autumn conference 2016 was held on October 19–22, 2016, at Welli Hilli Park, Korea. Main contents were: Invited Special Lecture, Award Lecture, Mutual Session with Acoustical Society of Korea, Industrial Session, Liberal Lecture, about 230 papers, and 28 exhibition booths.

New Officers and the Executive Council of 2017

The 15th president, Semyung Wang (GIST), along with senior vice president Heung Sik

Figure 1. Spring Conference 2016

Figure 2. New officers and the executive council of 2017

Kim (Honam University) and 30 members of the executive council were inaugurated for the January 2017–December 2017 term. [http://www.ksnve.or.kr]

Japan

1. The 2017 research meetings of the Acoustical Society of Japan (ASJ): The spring meeting will be held on March 15–17 at Meiji University, Kawasaki, with four structured sessions (see the 2016 December issue of NNI). It is reported that there are 583 papers including 275 poster presentations and 58 papers submitted for the four special sessions. The autumn meeting will be held on September 25–27 at Ehime University, Matsuyama. It is planned that ASJ and ASK (the Acoustical Society of Korea) will hold a joint special session as a one-room/one-day (or a half-day) session consisting of invited lectures from several research fields (e.g., noise, architectural acoustics, and speech).

2. The 2017 spring research meeting of the INCE/J: The spring research meeting will be held on Tuesday, April 21, at Chiba Institute of Technology, Chiba. The meeting is planned to consist of three structured sessions: (1) Recent topics and case studies on the measurement of noise emitted from various facilities and equipment, (2) Structuring of issues on acoustical environment: towards the formulation of guidelines for better sound environment planning, and (3) Aiming for the extension of INCE/J Method of Calculating Road Traffic Vibration "RTV-MODEL-2003."

3. INCE/J will hold a technical lecture meeting of "Involvement of Nurseries in Noise Problems—Creating an Acoustical Environment Necessary for Children to Grow Up," to celebrate the 40th anniversary of INCE/J foundation on Wednesday, March 8, 2017, at CHUO University, Tokyo. Recently, concern about noise accompanying usual activities at nursery facilities has emerged; establishing a kindergarten was reported canceled. There are several lectures providing the latest information on how to deal with the issue from the viewpoint of noise control, which is followed by a panel discussion.

4. INCE/J subcommittee for information exchange among local government members held a workshop "Engagement of Local Government in Noise Control—Airport and Aircraft Noise" on Monday, February 20, 2017, at CHUO University, Tokyo, with an audience of about 70 participants. There were six invited lectures talking about the role of the airport toward regional development and tourism, noise measures and land use control, noise measures at the source, air traffic control for noise impact mitigation, practices for noise mitigation by a local city government, and basics on noise, which was followed by a panel discussion.

5. Recent editions of the INCE/J Journal: The INCE/J Journal published last December (Vol. 40, No. 6) was a special issue on "Social Concern for the Acoustical Environment Accompanying the Enforcement of a Law for Solving the Discrimination Against Disabled," whereas the journal published this February (Vol. 41, No. 1) featured "Practical Use of Numerical Calculation Methods in Architectural Acoustics and Outdoor Environmental Noise."

6. The Smart Sound Design Society will hold a 4th SSDS Symposium "Branding Business by Applying Sound Design Technology" on Friday, March 3, 2017, at CHUO University, Tokyo (http://ssds.or.jp/seminar005). There will be four invited lectures: (1) Sound design by a Chinese consumer electronics company Vatti, (2) Present status of examining sound trademarks at the Patent Office, (3) Value creation of sound environment in offices etc., and (4) Effective utilization of acoustic effect in video works, which follows a panel discussion "Crosstalk on Branding Approach of Sound." Ease of listening to voice information is important not only for the elderly and hearing impaired, but also for healthy people to maintain and improve the quality of life as well as to secure the safety in case of evacuation guidance. SSDS plans to improve it by considering three factors of voice information, sound transmission, and sound reproduction environment in cooperation with various institutions.

(News sources) Australia and New Zealand: Marion Burgess and Truda King; KOREA: Yeon-June Kang (KSNVE Secretariat); and JAPAN: Ichiro Yamada, Takeshi TOI, and secretary offices of ASJ & INCE/J.

Book Reviews

Active Control of Noise and Vibration, 2e

Colin Hansen, Scott Snyder, Xiaojun Qiu, Laura Brooks, and Danielle Moreau
CRC Press, Taylor & Francis Group, Boca Raton, FL (2011)
1553 pp., (two-volume set), 610.95 USD
ISBN: 978-0-41-559061-7

In the preface to the first edition (1997) of this work, the authors (Hansen and Snyder) made a case for meeting the goal of "including the most recent theoretical and practical developments" pertaining to the fast growing field of active control of sound and vibration, and they bolstered the argument by mentioning that, at that time, the number of published research papers has been doubling every year over a decade and that "each year more researchers [were] becoming involved in this fascinating subject." The authors could have produced great work by simply concentrating on the most current developments in the field, but they also wanted to ensure that the fundamental mathematical and physical principles associated with active noise and vibration control (ANVC) were covered in great depth as these could be expected to remain time-invariant. The result was a tome of 1288 pages, which was praised by experts as a superb reference when dealing with the various topics associated with ANVC.

The second edition (2011) added three extra authors and quite a few extra pages (1528 pages plus 9 pages for the index) but the goal remained the same. The differences between the editions are the in-depth coverage of algorithms, hardware options for digital signal processing, as well as a broad (and yet focused) look at specific applications. What has not changed is the level of depth in the treatment of the topics, the ample derivations whenever they are required to ease the comprehension of the material, the clarity of the tables and figures, and the outstanding layout of the text.

Chapter 1 ("Background") provides a refreshing look at applications of ANVC from the perspective of how many patents worldwide have been applied for since 1987. Starting with less than five in 1987, the curve goes up steadily until 2007 where the aggregate of applications exceeds 250, but then it falls drastically to less than 80 worldwide, with just a handful of applications from the US and Korea, the two leaders in the field. Could this be showing that Hansen and Snyder were prescient, when 14 years before, they wrote the following in the preface to the first edition?

> So far, it seems that lawyers and judges have made more money from active control than any engineering company and they do not even own any patents! It is also of interest to ponder upon the number of patents which are granted that closely describe an aspect of active noise and vibration control which has been patented previously. All we can do here is try to appeal to some sense of reason as the results of too much litigation of this type will stifle research, slow down new product development and create a wealthy legal profession, all of which we would be better off without.

The chapter closes with a very concise and precise overview of the fundamentals of ANVC that apply to all the industry sectors identified by the authors. Materials from this portion could even be used to create the foundation to an "executive summary" for readers who have a reasonable grasp of general engineering control issues.

Chapter 2 delves deeply (173 pages) into the "Foundations of Acoustics and Vibration" and it is a full text by itself, suitable for upper-undergraduate and graduate reference work. The derivations are clear (thanks to examples) and almost 40 pages are dedicated to sound intensity and sound power, with an emphasis on structure-borne vibrational energy.

Chapters 3 and 4 ("Spectral Analysis" and "Modal Analysis") are also reference texts in their own right. Although the material may seem fundamental at first, it is very clear that the authors are always trying to present it in the context of ANVC. The result is a very "comforting guided walk" through the topic, always with excellent and easy-to-follow graphs and derivations.

Chapter 5 ("Modern Control Review") is a standard and clear text on control theory; however, the bar is being raised by the introduction of ANVC-specific elements such as forgetting factors and stochastic gradients. The reader is always brought back to ANVC through clear and effective examples. Chapter 6 takes over and immerses the reader *into* "Feed-Forward Control System Design" with an in-depth presentation (329 pages) of the topic, supported by detailed coverage of applicable algorithms. This is a "recipe book" for anyone looking at coding ANVC applications because the presentation of the various algorithms is accompanied by clear and well-referenced block diagrams.

Chapter 7 breaks from the theoretical fundamentals by dwelling into a very specific topic: "Control of Noise Propagating in Ducts" where the authors take the reader by the hand to guide her/him through the challenges associated with this application of ANVC. Once again, derivations are well-supported by clear figures and illustrations, and the 125 pages associated with the topic are by themselves a reference.

In Chapter 8, the authors take us from the confines of a duct into free space. "Active Control of Free-Field Sound Radiation" (159 pages) was my favorite chapter. The clarity of the presentation is outstanding because the authors use an almost surgical approach to each topic. For example, section 8.6 "Reference Sensor Location Considerations" is broken down

into three detailed subsections ("Problem Formulation," "Gain Margin," and "Phase Margin"), each using figures and derivations as needed. The clarity is simply outstanding.

Chapter 9 takes the reader back "indoors." We went into a duct (no fun), moved to the great outdoors (fun), and now we find ourselves in a middle-ground: planes, trains, and automobiles—these wonderful environments that travel with us but add noise along the way. "Control of Enclosed Sound Fields" is where vibration and airborne sound generation interact with each other to create some extremely complex issues as the spaces are relatively small (i.e., modal effects will yield large errors depending upon the placement of the sources and sensors) and the structural parameters of the enclosures add substantial complexity to the models. The chapter offers a nice range of references pertaining to ANVC applications in propeller-driven aircrafts and automobiles. Chapters 10 and 11 ("Feed-Forward Control of Vibration in Beams and Plates" and "Feedback Control of Flexible Structures") take the reader back to Chapter 6 with applications specific to solid 1-D and 2-D environments. Once again, the presentation of the materials is balanced between solidly referenced presentation of foundation material, derivation as needed, and examples.

Chapter 12 is a wonderful 136-page text on "Vibration Isolation" and this comes as no surprise considering Hansen's background and past writings on the topic. It is clear and perfectly organized, and it raises the complexity associated with the topic, especially when it comes to the implementation of effective models. The references are outstanding.

Chapter 13 ("Control System Implementation") brings a welcome "break" in terms of complexity associated with foundational material. My first impression was that this chapter should have been placed earlier in the tome, but then I realized that this may have been the choice of clever authors and editors. It works where it is because over the course of only 26 pages, the chapter brings back fundamentals in a refreshing fashion. It works, so leave it there!

Chapter 14 deals with "Sound Sources and Sound Sensors" and it is a very good presentation of the relevant parameters and variables associated with loudspeakers and microphones in the context of ANVC. The authors did an excellent job on covering the directionality parameters associated with both transducers, and the references are superb.

Following in the tradition of "airborne noise first, then vibration," Chapter 15 deals with "Vibration Sources and Vibration Sensors" and it echoes the model of the previous chapter: fundamentals are clearly presented with excellent figures and well-laid-out text, comments are focused and effective, and most impressive are the depth and breadth of references at the time of the writing.

To say that the 2nd edition of *Active Control of Noise and Vibration* is anything less than the reference in the topic of ANVC should be considered a crime (OK, OK, a misdemeanor). Some may even raise the question that the work was first published in 2011 (my review copy was dated 2013), so is there anything newer out there? The answer is "not really." Yes, there are a few more recent entries in very specialized areas (aircraft cabin noise and smart materials actuators), but the fact is that there is not one work that is as comprehensive and detailed as this one in the realm of ANVC. Anyone considering fundamental or applied research work in this field must take the plunge and buy this outstanding reference.

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Vibration Problems in Machines: Diagnosis and Resolution

Arthur W. Lees
CRC Press, Boca Raton, FL (2015)
332 pp., hardcover, 159.95 USD
ISBN: 9781498726740

This book is a very practical examination of rotating machine problems, with emphasis on the problems arising with the highest likelihood of occurrence, examined from theoretical, numerical, and empirical perspectives. The author has a unique and admirable biographical combination of real-world practical electric plant and academic research/teaching experience in the field of rotating machinery, and that dual-pronged practical and pedagogical emphasis pervades and enhances the book. In fact, a similar balanced utilization of actual measured machine data needed to improve theoretical or physics-based computational analyses and to gain additional insight is a major theme of the book.

It should be noted that the book is not, nor is it intended to be, an exhaustive general treatment of the dynamics of rotating machines. The author himself frequently refers to other more comprehensive texts on basic rotating machine dynamic theory, including his own 2010 text coauthored along with Michael I. Friswell et al., for more thorough discussions. Rather, this book, as the title states, is focused more toward increasing the understanding, diagnosis, and resolution of vibration *problems* in rotating machines.

While not immediately obvious when examining the many equations derived and explained throughout the book, the author puts a very strong reliance on the use of the finite element method (FEM) and other numerical modeling and simulation solution approaches in much of the book. This is not at all meant as a criticism since the FEM is certainly an important and highly useful approach to analyzing more

complex real-world, rotating machinery. I mention this merely for the information and benefit of the potential reader to note that most of the book's equations are in matrix form meant to be solved in a numerical or computational manner.

To that end, the author also strongly leverages the MathWorks MATLAB software in a supplementary manner in the book. Specifically, readers are directed to a website containing large library or toolbox of MATLAB scripts, interfaces, examples, etc., that nicely complement the theories and techniques discussed in the book. After a thorough review of the website, it is believed that these additional accompanying routines, user interfaces, and other commonly used task scripts offer the potential to significantly aide in the practical applications of the book's material by the reader and further enhances their learning experience.

Chapter 1 of the book is a relatively short introduction to the subject matter of monitoring, diagnosis, modeling, and classification of rotating machines. It includes brief discussions on monitoring and diagnosis of machines, including the measurement and utilization of standard parameters such as vibration, pressure, fluid flow rates, temperature, electrical current and voltage, and acoustic radiation. This first chapter also introduces (a) the concepts of fault localization, root cause, and remaining life in rotating machines, (b) the use of mathematical models (both analytic and numerical; both expanded in much more detail in Chapter 3), (c) machine classification, and (d) monitoring schemes.

This book's second chapter contains a brief yet informative treatment of each of a variety of data presentation formats including time and frequency plots, waterfall plots, scatter plots, shaft orbit shape plots, polar plots, and spectragrams. I particularly liked the manner of the discussion as it related the relative advantages/disadvantages and usefulness of each plot format to the others regarding shedding additional light toward the response of a rotating machine.

Chapter 3 introduces the fundamentals of modeling machines in both analytical and physics-based computational numerical forms. After a short general discussion on the necessity for theoretical models, this chapter includes a brief yet hands-on example treatment of the finite element method. Chapter 3 also discusses several analysis methods that can be utilized once the FEM matrices have been assembled to further examine faults in rotating machinery. Examples of analysis methods discussed include imbalance response, Campbell diagrams, analysis of damped systems, the root locus and stability method, and determination of the overall forced response behavior of systems subjected to harmonic excitation. The chapter concludes with a discussion on applying both vibrational mode shapes and also perturbation techniques to enhance understanding gained from models on rotating machine response behavior and its sensitivity to small changes in various system parameters.

Having laid a foundation in the book regarding the applicability and approaches to employing numerical models to predict the response behavior of rotating machines, the author then devotes the book's midsection in Chapters 4–6 to discussions of the most common problems or "faults" in rotating machines. Chapter 4 is devoted to detailed treatment of the most predominant source of problems in rotating machinery, the subject of rotor imbalance. While the majority of the chapter rightly delves into mass imbalance as the main cause of rotor imbalance, the chapter ends with a discussion of the assumptions of rigid versus flexible or elastic rotors and briefly considers synchronous vibration caused by rotor bending. The chapter also includes a number of approaches to improving rotor balancing, including both single- and two-plane balancing, as well as the modal balancing method for the reduction of flexible rotor imbalance-related vibration.

Continuing on the discussion of the most prevalent rotating machine problems, Chapter 5 begins with a fairly detailed coverage of the second most common fault source, misalignment. This discussion includes misalignment in both flexible and solid couplings in addition to misalignment inherent to the vibrational excitation. This chapter also briefly outlines other complicated and less understood machine problems, including cracked rotors, torsion, nonlinear systems, as well as the system-level, interrelated conditions of both synchronous and asynchronous excitation and vibration.

Chapter 6 concentrates on the major effects that rotor–stator interaction and clearances can have on rotating machine system dynamics, particularly clearances that are very small, direct contact, and/or those in which lubrication of some other heavy internal fluid is involved. Examples covered include interaction of rotating machine rotors and stators through a number of different types of bearings, bushes and seals, and in the worst case, direct rotor–stator dynamic contact.

Moving on from specific rotating machine faults, Chapters 7 and 8 cover the more general and higher-level concepts of machine identification and more specialized system analysis methods, respectively. Chapter 7 discusses opportunities for future progress in rotating machine identification and characterization along with more conceptual and mathematical approaches to updating and improving the fidelity of purely physics-based dynamic models using actual measured system data. Several recent methods and techniques for examining and analyzing system data are treated in Chapter 8. These include nondeterministic

methods such as artificial neural networks (ANNs) and their incorporation with physics-based models, kernel density estimations, Hilbert and wavelet transforms, and both mathematical and empirical decomposition techniques. This chapter further emphasizes the author's overall belief on the importance and benefits of using existing data to provide fundamental understanding and insight into a system's response behavior.

As an excellent presentation and attestation to the usefulness of the theories, methods, and techniques covered in the earlier chapters of this book, Chapter 9 contains a wide-ranging collection of five real-world case studies originally examined by the author and others in the literature. In all cases, a rotating machinery system contained a fault (or faults) of some kind and documentation of the system description, investigative analysis, and conclusions are presented and periodically tied back to specific sections and/or equations covered earlier in the book. Chapter 9 represents a nice addition to this book and provides a helpful and interesting practical treatment of the subject.

Chapter 10, titled "Overview and Outlook," is a short and more hypothetical, forward-looking, concluding chapter to the book. In addition to attempting to bring the reader up to the present in advances in instrumentation, data analysis, data handling, and modeling, the author also takes the opportunity in this final chapter to speculate to a degree on what kinds of things are potentially possible in the future in the analysis and particularly the control of rotating machines. For example, more futuristic topics such as expert systems, so-called smart machines that can automatically detect, diagnose and apply "corrective" action, advanced magnetic and electrorheological bearings, and active piezoelectric actuation of rotating shafts are discussed as areas for future development in the solution of vibration problems in rotating machines.

This book would be most useful as a teaching instrument in the classroom. There are approximately five or six limited but insight-provoking homework problems at the conclusion of each chapter. All of the solutions to those problems, along with additional helpful comments for each one, are contained in back of book. The examples in each chapter are illustrative and clear, but unfortunately limited in number. The number of examples for each earlier chapter averages on the order of two to three, while some later chapters have none. It would benefit later editions of this book to include more examples since they are well done and informative. However, it should be noted that the aforementioned online MATLAB toolbox does also contain several hands-on numerical examples for Chapters 5–7. Lastly, references are somewhat judiciously included but generally are from useful and helpful sources.

In closing, I very much enjoyed this book by Lees and found it to offer useful practical theories, techniques, and approaches to diagnosing and resolving vibration problems in rotating machines in an easy-to-read and instructive manner. Because of its interesting combined theoretical and practical approach, the book should be helpful and informative to a broad spectrum of practitioners and researchers interested in examining and solving undesirable vibration levels occurring within rotating machinery.

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Nonlinear Acoustics

Robert T. Beyer
Acoustical Society of America, Melville, NY (1997)
452 pp., hardcover, ASA members 45.00 USD
Non-members 70.00 USD
ISBN: 1-56396-724-3

and

Nonlinear Acoustics

Mark F. Hamilton and David T. Blackstock, Editors
Acoustical Society of America, Melville, NY (2008)
455 pp., hardcover, ASA members 45.00 USD,
Non-members 70.00 USD
ISBN: 0-9744067-5-9

These two books on nonlinear acoustics span a period of almost 25 years when referring to the dates of their original publication, 1974 and 1997, respectively. The older one was written entirely by Robert T. Beyer (1920–2008), former Professor of Physics at Brown University. The newer one was edited by M. F. Hamilton and D. T. Blackstock, both from the University of Texas in Austin, and is a compilation of 15 chapters, each written by different authors.

Beyer's book is printed on US letter-size paper format; thus, giving the false impression of a textbook resulting from lecturing. Owing to this paper size, almost all diagrams and pictures are of a remarkable large size that makes them easy to study and understand. Derivation of equations uses multiple steps to not just show the initial step and the final result; in other words, it is a book on nonlinear acoustics for reading.

The book splits into 12 chapters, each ending with an exhaustive reference list:

1. "Introduction"—using the "normal" wave equation as a starting point (being a linear approximation for low Mach numbers) and explaining some historical aspects of non-linear effects, such as vortex sound, shock waves, radiation pressure, streaming and cavitation.
2. "Principles of Linear Acoustics"—discusses vibrations supposed to be linear acoustics, but in fact being approximations of more general non-linear phenomena (e.g., linear vibrations of a string at "small"

displacements, that is, "small" compared with the string's length, or radiation from a piston, not only into far-field and at low frequencies).

3. "Some Sources of Nonlinear Oscillations"—reflects on a simple pendulum, non-linear springs (like most "real springs"), membranes (with "infinite" small thickness) and plates (with finite thickness) as two-dimensional examples—further an excursus to the non-linearity of the human ear (keyword: "Tartini" tones).
4. "Nonlinear Propagation in Fluids"—is the largest chapter of the book covering more than 60 pages, discussing the effect of compressibility and the famous B/A ratio term (parameter of nonlinearity). The chapter explains the development of theories on the propagation of sounds in fluids, including Blackstock's bridging function, the editor/author of the second book in this review (so forming a "bridge" in a double sense).
5. "Shock Waves"—became relevant with more and more powerful technical sources of sound/noise, such as explosions, artillery projectiles, supersonic aircraft and rockets. The physics of these effects involves some thermodynamics, depending on the medium of propagation (gazes or liquids).
6. "Aeroacoustics"—starts with an account on Lighthill's theory and discusses the basic aeroacoustic sources, such as monopole, dipole and quadrupole, closing with vortex sound ("Karman" street) as a special kind of dipole radiation.
7. "Radiation Pressure"—describes effects by beamforming of acoustical energy, in special at boundaries between liquids or between a liquid and air (known as "acoustic fountain").
8. "Streaming"—discusses bulk flow inside a fluid induced by non-linear acoustic effects when waves travel through it. For example, the motion of particles at standing waves in Kundt's tube is due to streaming.
9. "Cavitation"—presents basic phenomena using bubble theory, deriving thresholds for cavitation theoretically. Non-linearity originates here from the description of the dynamics of bubbles, both for growth and collapse. Noise is caused by collapse and by oscillation of the bubbles.
10. "Nonlinear Interaction of Sound Waves"—are an extension of the preceding chapter "Nonlinear Propagation in Fluids," this time focusing on interaction. Relevant theories developed over the decades—starting from Lighthill's theory—are discussed. These interactions may lead to absorption and scattering of sound by sound.
11. "Applications of Nonlinear Interactions"—discusses in 35 pages in detail the parametric array applied in ultrasonics, both for transmitting and receiving applications.
12. "Nonlinear Propagation in Solids"—is not so much looking at what engineers call "structureborne sound" phenomena, but more pointing at an elastic arrangement of atoms or molecules in solids. In solid-state physics, the energy is supposed to be transmitted by "phonons" representing the "quantization" of the modes of vibrations of elastic material. This chapter discusses non-linear effects found at lattices representing solids.

The appendix dates from 1997 and picks up all topics from the previous chapters and gives updated comments and a lot of newer references.

The book edited by Hamilton and Blackstock was originally published in the same year that the reprint of Beyer's book appeared. So, from the reader's point of view, it would be nice to know what the differences are and what book to recommend for whom—assuming you were interested in non-linear acoustics at all. To give you a clue right away, both are mathematically challenging; Beyer's book has more derivations, which makes it easier for the reader to follow, but offers less topics and does not focus so much on practical applications. In opposite, the book edited by Hamilton and Blackstock covers more topics and presents a larger number of application cases where a non-linear approach is a "must."

This book has 15 chapters dealing with the following topics (author/s in parentheses):

1. History of Nonlinear Acoustics: 1750's–1930's (Blackstock)
2. The Parameter B/A (Beyer)
3. Model Equations (Hamilton, Morfey)
4. Progressive Waves in Lossless and Lossy Fluids (Blackstock, Hamilton, Pierce)
5. Dispersion (Hamilton, Il'inskii, Zabolotskaya)
6. Radiation Pressure and Acoustic Levitation (Wang, Lee)
7. Acoustic Streaming (Nyborg)
8. Sound Beams (Hamilton)
9. Finite-Amplitude Waves in Solids (Norris)
10. Perturbation Methods (Ginsberg)
11. Computational Methods (Ginsberg, Hamilton)
12. Propagation in Inhomogeneous Media, Ray Theory (Morfey, Cotaras)
13. Statistical Phenomena (Gurbatov, Rudenko)

14. Parametric Layers, Four-Wave Mixing, and Wave-Front Reversal (Simpson, Marston)
15. Biomedical Applications (Carstensen, Bacon)

Chapters 1 through 9 match with similar chapters in Beyer's book. Chapters 10 through 15 discuss, on a very profound and sophisticated mathematical level, theories and propagation models to explain and predict phenomena requiring a non-linear approach. Most of the theories and propagation models proposed and explained rely on the knowledge of several material parameters forming the input data. So, it comes to the question on how to properly gain these material parameters to prove these theories and propagation models.

My final advice is as follows: If you are looking for a book to get a first insight into non-linear acoustics, go for Beyer's book. If you are working in the field of acoustics where non-linear approach is required, such as biomedics, you will find the book edited by Hamilton and Blackstock more challenging. You may keep in mind, however, that even the latter might not be up-to-date.

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Propagation of Sound in the Ocean

J. Lamar Worzel, C. L. Pekeris, and Maurice Ewing
Acoustical Society of America, Melville, NY (2000)
361 pp., hardcover, 37.00 USD,
ISBN: 1-56396-968-8

This is the Acoustical Society of America's republishing, in 2000, of "The Geological Society of America Memoir 27," which was originally published by that society in 1948 and then reprinted in 1963. The original publication is a collection of three papers considered to be classic in the understanding of underwater acoustics. ASA's reprinting appends six additional articles.

The many oscillograph and journal article reproductions throughout the book are very difficult to read, chiefly due to scanning at too low resolution and the reduction of the appended journal articles to fit the 5×7 print format. For researchers needing more detail, the 1963 reprinting can still be found, with its collotype plate printing allowing one to clearly read the oscillographs right down to the operator's scribbled notes.

1. The Original Three Papers

The original three papers are summary reports of previously secret classified collaborative work between Woods Hole Oceanographic Institute geophysics professor Maurice Ewing, his former student Joe Worzel, and Columbia University professor Chaim Pekeris.

2. Explosion Sounds in Shallow Water—Worzel and Ewing

A particularly effective weapon used during WWII was the acoustic mine. These mines typically were laid on the bottom in shallow water to intercept convoy routes. Each mine was equipped with a hydrophone and circuitry that measured the broadband noise level. The mine was set to explode when the noise level reached a level that corresponded to that of a large ship. Many ships along the US eastern seaboard were being damaged or sunk by this type of mine, so in the winter of 1943, Worzel and Ewing's team were directed to collect the shallow water acoustic transmission data needed to design effective countermeasures.

Anyone who has participated in collecting acoustic data at sea will immediately appreciate the Spartan conditions of this first shallow water expedition: most of the recordings were made on an 8 pen oscillograph; their vessel was the USS Saluda IX 87 (an 88 ft. sailing yacht); and their 125 ft. target ship USCGC Rush II also served as their anti-sub escort. I was pleased to find that the Saluda is still sailing as the Sea Scout's SSS Odyssey (visit the ship on their website www.sssodyssey.org).

The field tests comprised dropping explosive charges from the Rush as it moved away from the Saluda. Saluda recorded the received signals through two different hydrophones and a geophone placed on the bottom. Tests were performed at various locations to determine the effect of different sea beds. As with any test, problems came up and solutions had to be pieced together from what was readily available. The resulting graphs and charts are honestly documented with notes such as "wrong gain" and it is amusing to read between the lines of their description of having to kludge together a hydrophone calibrator from a variable air capacitor that was "varied approximately sinusoidally."

Worzel and Ewing's work was important in showing that low frequency propagation in shallow water is conducted through the ocean floor layers and for discovering the "Ewing effect," which causes frequency dispersion of sound in shallow water.

3. Theory of Propagation of Explosive Sounds in Shallow Water—Pekeris

Worzel and Ewing collaborated extensively with Pekeris to work out empirical equations to fit their data, which could then be quickly used in countermeasure operations to determine maximum acoustic ranges. They converted all of their data to apply to standard 25 pound TNT charges then used by sub-chasers. The resulting equations were able to predict ranges in most, but not all, of the shallow water conditions they had recorded. Shallow water acoustics was (and still is) a complicated system to mathematically model. It was even more difficult in the

1940s when solutions needed to be closed form and highly simplified for slide rule calculations. Pekeris' paper reviews Worzel and Ewing's data (actually doing a much better job of it than in the first paper) and develops a normal mode theory of shallow water sound propagation that accurately predicts the "Ewing effect." I found it an interesting sign of the times that Pekeris invokes quantum theory as a possible solution to a particular acoustic phenomenon.

Collaboration worked both directions. Checking his resulting model with the data, Pekeris discovered one outlier and called Ewing to see if it had been written down wrong. Both decided that the water depth in that dataset should have been 53 ft. instead of 25 ft. and this change made the outlier fall in line with the theory.

4. Long Range Sound Transmission—Ewing and Worzel

The last of the original three papers is an investigation to confirm the existence of the deep sound channel. This is a low loss channel located at the depth of minimum sound velocity in which sound may travel very long distances with little loss in energy. Once established, this phenomenon was exploited during the war as the SOFAR method of locating and rescuing downed pilots. The pilot would release a small explosive which would explode at depth. The distinctive sound would travel thousands of miles to several shore stations, which could then triangulate the pilot's position and direct rescuers to the crash site. Although they did not identify it at the time, the hand-drawn ray diagram (Figure 5) included in this paper shows a convergence zone, the effect that causes long range sound rays to converge at or near the surface approximately every 30 miles from the source.

5. The Six Appended Papers

The six papers appended to this edition include an analysis of shadow zone formation, a quick derivation of acoustic scattering equations, the discovery of SOFAR transmitted sound from earthquakes showing up on seismograms and its possible association with tsunamis, and the extension of both normal mode and ray theories of shallow water acoustic propagation to multiple layers to allow for more realistic modeling of the surface, bottom, and water column.

Although the printing lacks great detail and there is no editor's comment on the selection process and significance of the appended papers, future progress in any technical field stands on the shoulders of giants in the past and, on that basis alone, I recommend this republished collection.

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Acoustics—An Introduction

Heinrich Kuttruff
Taylor and Francis, NY (2007)
457 pp., 75.13 USD
ISBN: 978-0415386807

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 chapters in total, with the first five 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 ten 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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Sound—A Very Short Introduction

Mike Goldsmith
Oxford University Press, Oxford, UK (2015)
140 pp., 11.95 USD
ISBN: 978-0-19-870844-5

Wow! This book is nice . . . and cute. It is a bit bigger than one and a half iPhone mobile phones placed side to side, about as thick as one too, and only 140 pages, making this a nice travel book.

It is perhaps one of 100 books that have "A very short introduction" as part of their title. Others in the series include topics such as evolution, martyrdom, African religions, and quantum theory. There are dozens more.

Mike Goldsmith is the former head of the acoustic group at the United Kingdom's National Physical Laboratory and an author of many books for general readers. Two of his books have been short-listed for the Aventis prize (now the Royal Society prize) for science books. His most recent book is "Discord: The Story of Noise." I will go over the sections and chapters one by one, although I must keep my comments short; otherwise, the review will be longer than the book. Here we go.

List of Illustrations: This consists of 23 illustrations covering just about everything—wave shapes, constructive

interference, the ear, condenser microphone, and active noise cancellation. The list goes on.

The Sound Spectrum: This is a list of things and their frequencies—from a volcano, to the highest recorded note sung by a human, to an acoustic microscope.

1. "Past Sounds": When he says "past" he means "past." Starting with 13.7 billion years ago (in those days, they only had coal-powered sound level meters) and the very first sounds on earth, he discusses sound through the ages, 40,000 years ago, 2,500 years ago, and up to modern times. The modern times include Pierre Laplace (1800s) up to the present—including sound art and soundscapes. It is a great introduction to the field, albeit only nine pages.
2. "The Nature of Sound": This chapter introduces pressure waves and their propagation, reflection, refraction, and even sound power. Furthermore, it discusses wave forms, loudness, standing waves, filters, and even decibels. Everything is in 26 pages.
3. "Sounds in Harmony": The 16 pages discuss sound as music. It includes singing (and learning to sing), notes, being "in tune," music making, scales, why they picked 8 of the 12 notes to form an octave, sequences, and instruments.
4. "Hearing Sound": The physiology and psychology of sound discussed including parts of the ear (my favorite is the outer ear, a place to hold my glasses), the transition of pressure waves from sound to brain to hearing, directionality, deafness, and speech. All is in 17 pages.
5. "Electronic Sound": What is this about? This is not about electric music, per se, but sound to electricity (and maybe back to sound): microphones, loudspeakers, instruments, Helmholtz resonators, and storage devices (16 pages).
6. "Ultrasound and Infrasound": In 13 pages, Goldsmith partly talks about bat hearing but also medical ultrasound and a bit about infrasound.
7. "Sound Underwater and Sound Underground": This chapter discusses the first use of underwater sound where the military, mistakenly thinking that the sounds in the Chesapeake Bay during WWII were enemy submarines, depth-charged and killed millions of "loud" fish. Further, a brief physiology of marine creature's ears is discussed along with techniques to hear and measure underwater noise. Goldsmith goes on to discuss sound propagation in water and how whales at one of the earth's poles can hear whales at the other one (13 pages).
8. "Sound Out of Place": This last 17-page chapter is about noise. It treats sources, noise issues between people, noise source identification, and ways to quiet (noise cancellation, noise "attenuators," distance, etc.). Finally, it has a brief discussion of quieting the home.
9. "References": Separated by chapter and perhaps up to 15 useful references for each.

Further Reading: This is also by chapter and includes several references, citing Bob Beyer and Dan Raichel among many others.

Index: This is a very comprehensive index. Well done. The well-written book is full of clear illustrations and well-described tables and is a pleasure to read. Fortunately, there are no Bessel functions to get in the way.

I highly recommend this book. Perhaps this is the best general book discussing "acoustics" in a very elementary sense. Goldsmith is a good writer and the book has a comprehensive review, given the brevity of treatment and the small format. It is perfect for a short seminar or to help explain part of what we do to someone who knows how to read. It is a wonderful and delightful book. Buy it. Buy two!

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Sound, Structures, and Their Interaction, 2e

Miguel C. Junger and David Feit
Acoustical Society of America through the American Institute of Physics (1993)
451 pp., 23.00 USD
ISBN: 0-262-10034-7

Sound, Structures and Their Interaction was originally published in 1972 by the Massachusetts Institute of Technology. This latest edition is more than 20 years newer, and it is more than 20 years since this latest edition has been published.

What it is basically about: If a sound wave hits a structure, it causes loading (and vibration) on the structure and the loading depends, in part, on the shape of the structure, the "intensity of the sound," and on the density of the medium in which the sound is propagating. Similarly, if a structure vibrates, it produces a sound wave. The interaction between sound and structures is complex. The authors discuss homogeneous structures and fluid media, especially useful for near-field structural response. This is a very theoretical text meant for graduate students with math background or those experienced in the field of acoustics.

The twelve chapters, each with five to nineteen sections, and some with numerous excellent references after each chapter, are the following:

1. Statement of the Problem (including a short discussion of the historical development of structural acoustics)
2. The Wave Equation and Its Elementary Solutions

3. Applications of the Elementary Acoustic Solutions
4. The Pressure Field of Arbitrary Source Configurations
5. Plane Sound Radiators
6. Convex Found Radiators
7. Vibrations of Beams, Plates, and Shells
8. Sound Radiation from Submerged Plates
9. Sound Radiation by Shells at Low and Middle Frequencies
10. Scattering of Sound by Rigid Boundaries
11. Elastic Scatters and Waveguides
12. High-Frequency Formulations of Acoustic and Structural Vibration Problems

Also, included at the end are a glossary, an index, and an errata page.

There are differences between this and the 1972 edition, and these are significant enough to say that, if you have and like the first edition, you might want to get this version, too. There is more content. For example, in this new edition, the chapter on "Sound Radiation from Submerged Plates" has been rewritten to have a closer look at near-field effects and the effects of load distribution to far-field directivity and sound power.

The chapters are well written and take the reader through the book in an organized fashion. It is very theoretical and the reader needs to be somewhat fluent in vector mathematics.

This book, along with the first edition, is classic in the field. It is highly recommended.

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Architectural Acoustics Illustrated

Michael Ermann
John Wiley & Sons, New York (2015)
272 pp., 85.00 USD
ISBN: 978-1-118-56849-1

The purpose of this book is to translate the concepts of architectural acoustics into the graphic language of architecture. Not only should architects and architecture students be served by the information in this book, but also engineers, physicists, musicians, builders, planners, real estate professionals, and laypeople interested in acoustics and architecture.

The author conveys the importance of room shaping over motorized components, material selection over sound system design, noise-space planning over engineered partitions, site selection over outdoor noise barriers—without omitting or diminishing the important content of motorized components, sound system design, engineered walls, and outdoor noise barriers. The intent is to allow users to design rooms and spaces with sound in mind from the earliest stages of design, when decisions have the greatest impact on the quality of the acoustics. The book also points out where acoustic opportunities and pitfalls lie, addresses routine matters in architectural acoustics, and helps the reader judge when outside professional consultation is required.

Chapter 1, "Basic Theory," provides a detailed discussion of sound level, sound propagation, and sound frequency. Sound level discussion includes source path receiver, measuring sound level, multiple sound sources, and decibel addition. Sound propagation includes brief descriptions of sound propagation and directivity and provides excellent graphical examples of each. Sound frequency discussion includes frequency, octave bands, sound level perception and frequency, A-weighted decibels, and the special case of low-frequency sound. There is no chapter summary, but a short reference section is included relating to the chapter topics.

Chapter 2, "Sound Absorption," includes discussion, illustrations, and practical tables for the topics of principles of absorptive and reflective surfaces, absorption coefficient, types of sound absorbers, room constant absorption, room average absorption, noise reduction coefficient, and sound absorption data. This chapter does not include a summary, but includes a reference section to specific topics cited in the text. This chapter also includes a comprehensive set of illustrations and images detailing each area of discussion within the chapter.

Chapter 3, "Room Acoustics," provides a detailed look at the complexities of room geometry and its relationship to sound design and engineering. Topics include room acoustic qualities, theater planning, acoustic defects, performance venues, design checklists, and sound system design. Room acoustic qualities discussion includes impulse response, reverberance, optimal reverberation time, clarity, variable acoustics, reverberation time calculation checklist, room shaping for speech and music, loudness, balconies, sightlines, warmth, concert hall types, spatial impression, intimacy, and diffusion. Theater planning includes stage acoustics, orchestra pits, and what makes a good room for music and performance venue seats. Acoustic defects illustrate the effects of and potential solutions for echo, flutter echo, sound focusing, acoustical creep, excessive loudness, and resonance. Performance venues discussion focuses on room acoustics history and provides suggestions for performance venues to visit. Design checklists are provided for rooms for unamplified music performance, opera houses, multipurpose spaces, lecture halls, classrooms, worship spaces, and conference rooms. Finally, sound system design is a short section that focuses on electronic sound reinforcement and provides a few examples on shapes

and features that improve or reduce performance. This chapter concludes with a comprehensive list of references.

Chapter 4, "Noise Control," includes comprehensive discussion and illustrations on the topics of sound isolation principles, measures of airborne sound isolation, background noise, door and window sound isolation, impact noise, community noise, and mechanical system noise. Sound isolation principles focus on flanking and provide an apartment layout graphic quiz and a flanking graphic checklist and flanking noise checklist. Measures of sound isolation include transmission loss, sound transmission class (STC), techniques to measure STC, target STC ratings, noise reduction, and ways to achieve higher acoustical privacy. Background noise includes noise criteria, speech intelligibility and noise, open-plan office acoustics, sound transmission loss data, noise reduction example problem, and air-structure-air flanking and provides an acoustic privacy checklist and an apartment layout quiz. Door and window sound isolation discusses door type and placement, and noise isolation and window characteristics. Impact noise discusses and illustrates impact noise isolation and how to measure the impact isolation class of material, provides an impact noise checklist, includes recommended floor–ceiling assemblies, and discusses resiliently mounted room surfaces. Community noise includes principles of community noise, building-in-building design, noise sources, community noise research, community noise example problems, outdoor barriers, wind turbine noise, an outdoor barrier checklist, and a community noise checklist. Finally, mechanical system noise discusses the principles of mechanical system noise, ducted fan noise, ducted air turbulence noise, vibration isolation, plumbing noise, and isolating pipes from structure. It also includes checklists for mechanical rooms, mechanical noise, and plumbing noise. Again, the chapter concludes without a summary but provides a detailed reference section.

Architectural Acoustics Illustrated is a comprehensive book recommended for those new or relatively new to acoustics, but those in practice as architectural acousticians will also find it valuable as a reference for its considerable library of data, its review of recent research, and its design checklists. The book provides an excellent source of very detailed graphical depictions, illustrations, tables, checklists, and examples for each topic area, and includes a corresponding straightforward and detailed explanation for each.

At various points throughout the book, there is an AV Content Online icon that invites the reader to explore further details on the subject matter by directing them to the Architectural Acoustics Illustrated Companion Site Content at www.wiley.com/go/architecturalacoustics. This site contains 19 separate videos corresponding to specific sections within the text and provides an excellent visual and auditory dissection and enhancement of those sections. While the illustrations, graphics, and tables in the book are in and of themselves very capable of supporting the relevant concepts outlined in the text, the videos add an extra touch of clarity in a way that only sound and motion can provide.

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Acoustical Design of Theaters for Drama Performance: 1985–2010

David T. Bradley, Erica E. Ryherd, and Michelle C. Vigeant, Editors
Acoustical Society of America, Melville, NY (2010)
334 pp., hardcover, 45.00 USD
ISBN: 978-0-9846084-5-4

This book is an excellent compilation of the architectural and acoustical designs of 130 theaters from around the world. The book covers the work carried out in the 25 years during 1985 to 2010. The editors have done excellent work in putting together highly useful information about these theaters, which represent a rich diversity ranging from formal proscenium theaters to flexible black-box performance spaces. The editors, in their preface, have nicely described the context for this work and have categorized the 130 theaters into 83 proscenium theaters, 15 thrust theaters, 15 black box and multi-form theaters, and 17 alternative-form theaters.

Before presenting the details of the theaters, the book has a nicely written introductory essay contributed by three authors. In the first part, Robert Long describes the changes and trends in the theater design during 1985 to 2010. In the second part, Robert Campbell discusses on finding a balance between theater function, architecture, and acoustics, and in the third part, Todd Hensley provides a theater consultant's view of working with architectural acoustics consultants. In another interesting and insightful essay "Acoustics on a Budget," Howard Shalwitz describes various aspects confronted in the design of the award-winning Wooly Mammoth Theater in Washington, DC. These essays provide a nice comprehensive description of the nature of work involved in the acoustics and architecture of theaters. These essays nicely complement the acoustical data and architectural drawings.

The book provides technical descriptions, photographs of the interior and exterior, drawings, and the acoustical data such as reverberation times and/or background noise levels based on octave bands. The descriptions of theaters give information on acoustical consultant, architect, theater consultant, owner, room volume, seating capacity, cost, and completion date. The photographs, which are of excellent quality, are a visual treat of the architecture

and acoustics of the theaters. The book has very useful appendices, such as an overview of acoustic design for drama theaters, glossary, location of theaters and consulting firms along with the theaters that they worked, and references.

In summary, this book is a useful and an excellent addition to the field of architectural acoustics and particularly to the area of acoustical design of theaters.

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Opera House Acoustics Based on Subjective Preference Theory

Yoichi Ando Springer, NY (2015)
179 pp., hardcover, 99.00 USD
ISBN: 978-4-431-55422-6

Table of Contents

This book's focus is on opera house acoustics based on subjective preference theory. Individuals not familiar with the subject are provided with a step-by-step presentation of the mathematical factors that characterize the subjective preferences of the sound field. Extensive references are provided with each chapter, so those so inclined to understand the subject matter at a deeper level or from a more detailed mathematical foundation are provided the references to more easily do so. The content allows exploration of the auditory-brain system in the fields of acoustics, as well as psychology and brain physiology. The organization of content is intended to assist the reader in understanding subjective attributes in relation to objective parameters based on this contemporary model of the auditory system.

Since the 1980s, there has been notable progress in temporal- and spatial-primary principles of sound and subjective preference based on neural evidences in the auditory-brain system. Yochi Ando was a leading researcher in this field in the early 80s, when case studies and computer analysis of the data were the available tools of research. Chapters 2 and 3 of this book restructure the surfeit of parameters from the computer era into four independent parameters. Ando begins his book by defining the running autocorrelation function to prove that it contains the same information as the power density spectrum, which allows the definition of the auditory experience in the time domain. This in turn opens the door to a definition of what we hear that is not fully addressed by the Helmholtz theory, which was based on a peripheral model of the auditory system. Ando then further details how past methods do not properly model pitch, timbre, and duration as well as the spatial sensations, as does subjective preference theory. Chapter 4 presents Ando's original point of view of perception.

The use of magnetic resonance imaging (MRI) to view brain activity has facilitated the comprehension of the auditory-brain system and the relevance of subjective preference theory. Neural activities have been discovered related to subjective preferences of the sound field. A general strategy evolved from the use of the MRI that agreed with the original case studies for the design of an opera house to characterize what a person experiences (percepts) and what they prefer to experience, optimizing their environments to realize their preferences. Percepts involve time and space; such that temporal and spatial factors determine different sets of experienced qualities. The temporal criteria drive the left hemisphere, while factors related to spatial patterns engage the right hemisphere. The subjective preference theory is modeled to serve as the bridge of the right and left brain in the auditory experience. Any overall personal responses such as speech recognition, reverberance, and/or the sound field can be well described by temporal factors extracted from the running autocorrelation function (ACF) and spatial factors from the interaural cross correlation function (IACF), which is explained in Ando's book.

The neural connection between perception and preference is then presented in Chapters 5 and 6. Chapter 7 presents the link between temporal and spatial factors and physical parameters easily evaluated in the field and demonstrated for an existing opera house. The reverberance of the sound field is then examined for an existing hall, using the four orthogonal factors presented in prior chapters. Chapters 9–12 then provide an overview as how to improve an existing opera house based on subjective preferences, and then conclude with the subjective preference theory design theory for a new opera house design. The presentation of subject matter on room optimization is provided in a format that is of value to acoustic engineers, as well as for both performers and designers. With the recent growth of virtual reality glasses and systems, the understanding of subjective

preference theory takes on a greater importance for all applications and will become an important thread in the opera house design.

This book is part of "Mathematics for Industry" (sometimes abbreviated as MI) series that is intended to serve as a mathematical foundation for creating future research and technologies. The various mathematical concepts are clearly and succinctly summarized in combination with drawings and diagrams. This combination of mathematical concepts illustrated by visuals creates a content that can be understood by designers and performers that do not easily use mathematics, as well as engineers and mathematicians.

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Acoustic Absorbers and Diffusers Theory, Design and Application, 3e

Trevor J. Cox and Peter D'Antonio
CRC Press, Boca Raton, FL (2016)
520 pp., 140.00 USD
ISBN: 9781498740999

Until 2004 there was no single textbook dedicated to the theory of acoustic materials, other than the Kosten and Zwikker book *Sound Absorbing Materials*, published in 1949. *Acoustic Absorbers and Diffusers Theory, Design and Application* is the third edition in 12 years of this inclusive text. All chapters have been updated with this edition. New topics include sustainability, fast time-domain models for diffusers, current measurement standards, and improved techniques for prediction of porous absorbers, sound reflecting surfaces, and diffusers. Most prediction methods in the book are linked to downloadable MATLABW scripts.

Like earlier editions, the book provides both practical and theoretical aspects of sound absorbing and diffusing surfaces. Chapters are presented in a narrative format before introducing the modeling methods. Each chapter concludes with an extensive reference list for those desiring more information.

The authors are eminently qualified to write about the topics covered in this book, having worked independently and together in developing the theory of numerically derived sound diffusing surfaces. Trevor Cox is Professor of Acoustic Engineering at the University of Salford (UK) where he has conducted research on scattering provided by optimized sound diffusing surfaces. Peter D'Antonio was founder of RPG Diffusor Systems, Inc., a manufacturer of commercial sound diffusing and absorptive products.

Chapter 1 contrasts absorption versus diffuse sound reflections. Sustainability of materials used to manufacture sound absorptive and diffusive products is reviewed.

Applications and principles of sound absorbing materials are covered in Chapter 2 to include modal and specular reflection control. Non-architectural acoustic considerations describe enclosures, barriers, automotive, and loudspeaker applications for sound absorbing materials.

Chapter 3 covers principles and applications of sound diffusing surfaces to include studios, stages, auditoria, and sound field coloration in small rooms.

The measurement of sound absorptive properties is the subject of Chapter 4. Topics include impedance tube, two-microphone techniques, in-situ and reverberation chamber measurements, and evaluating internal physical properties of sound absorptive materials.

Chapter 5 covers measuring sound diffusive surface properties with primary emphasis on the diffusion and the scattering coefficients to include the evolution, measurement, and prediction of these metrics.

Absorption mechanisms of different porous materials are described in Chapter 6. Included are modeling sound propagation within porous materials and predicting surface impedance properties.

Chapter 7 addresses resonant absorbers of various types, their design equations, and resonant frequencies. Unique constructions and advances in material technologies are described.

Non-standard sound absorbers are covered in Chapter 8 to include audience and seating, Schroeder diffusers, and absorption by vegetation.

Chapter 9 reviews in considerable detail the theory of sound reflection and scattering using frequency and time domain models to include boundary element, Fraunhofer, Fourier, and finite difference time domain methods. A useful table that describes which technique is the most appropriate for the intended analysis is included.

Schroeder diffusers are the subject of Chapter 10. Topics covered include sequences, periodicity and modulation, absorption, and optimization for one-dimension sound-diffusing surfaces.

Chapter 11 covers geometric sound diffusers starting with plane surfaces, progressing to triangular and curved surfaces, and optimization to enhance diffusion and prevent sound focusing.

Hybrid surfaces, those that include varying impedance and shaping, are described in Chapter 12. These surfaces can provide sound absorption and scattering in both one and two dimensions depending on the surface geometry.

Chapter 13 discusses the transition from surface acoustic properties to room acoustic predictions using geometric room acoustic models, and how sound

absorber and diffuser acoustic properties should be applied. A primary focus is on the application of sound absorption coefficients obtained by various methods and the use of scattering coefficients applied to surfaces.

The book concludes with Chapter 14 covering active sound absorbers—those using some form of loudspeaker and control system. The advantages of this technology for controlling selected low frequency sound are described as are technological problems, which have limited its application.

This revised edition consolidates the research and theory of acoustic materials known to date and will be a valuable resource for acoustic researchers, consultants, and acoustic product manufacturers. I would also expect acoustic standards committee members to find useful information for consideration in future standards revisions relating to acoustic materials measurement. The publishers have created a quality book with easy-to-read text fonts, uniformly formatted equations, distinct line art, and clearly reproduced photographs. If you have an earlier edition, as I do, there is sufficient new material in this edition to recommend purchasing this reference volume.

Lastly, I would like to see the publisher award a prize to the reader who can correctly identify first the six acoustic researchers that appear on the book's cover.

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Acoustical Designing in Architecture

O. Knudsen and C. M. Harris
Acoustical Society of America, NY (1950 and 1978)
408 pp., paperback, 23.00 USD
ISBN: 978-0883182673

It has been more than 65 years since the book *Acoustical Designing in Architecture*, written by V. O. Knudsen and C. M. Harris, was first published (in 1950) and this small book, reprinted in 1978, is still very useful, relevant, and is a very practical contribution for any young acoustical consultant or architect who seeks perfection in his/her building design work.

Before I start my short review of the book, I'd like to make two short confessions:

1. I bought this book in the mid-80s, almost 30 years ago, and still I love this book as one of the very comprehensive, efficient, basic, professional books available for anyone who deals in architectural acoustics. When I bought it, I heard of the name of Cyril Harris, one of the two authors of the book, as a professor of acoustics in the USA. He and I met in New York City while he taught acoustical courses at Columbia University. The last time we met was in an apartment in Jerusalem, where I live and run my small acoustical firm.

2. My acoustic mentor for my PhD degree, Giora Rosenhouse, taught me in my early years in the Technion, Israel Institute of Technology in Haifa, that "it is not enough to learn and understand the physical background of basic acoustical knowledge to be a professional acoustical consultant — you still need to know the building material market, their prices and to know the contractors and their experiences. Without those three components, you will never be an expert."

The book we discuss now has almost two of three components needed to become proficient.

In the beginning of the preface of the second edition of the book, Harris wrote, "During the thirty years since publication of the original edition of *Acoustical Designing in Architecture* . . . students in my class in Columbia University as well as practicing architects . . . have continued to find the text a valuable tool in the study of principles of architectural acoustics and their applications to the solutions of practical problems." No doubt, 65 years after the first edition of the book was published, it is easy for me to conclude that this small book is valuable to every young acoustical consultant in his/her early stages, and is a very valuable, comprehensive, basic tool to understand or investigate the principles of architectural acoustics and their applications, which have a large range of solutions for common and practical problems.

The book does not contain sophisticated mathematics or physics so the average reader can follow it and can easily understand the acoustics presented. To this day, still, no high degree of science background is needed to follow or understand acoustical behavior in different situations in a building, even though it has been many years since this book was written.

The paperback book contains 403 pages in 20 chapters and three appendices.

The 20 chapters in the book can be divided into three major sections:

I Basics

1. Properties of Sound
2. How We Hear
3. Speech and Music

II A few chapters of the general acoustical behavior including:

4. Reflection and Diffraction of Sound in Rooms
5. Open-Air Theaters
6. Sound-Absorptive Materials
7. Special Sound-Absorptive Constructions
8. Principles of Room Acoustics
9. Acoustical Design of Rooms
10. Noise Control

11. Reduction of Airborne Noise
12. Reduction of Solid Borne Noise
13. Control of Noise in Ventilating Systems
14. Sound Amplification Systems

III And last, some architectural acoustics design recommendations for several typical buildings, including:

15. Auditoriums
16. School Buildings
17. Commercial and Public Buildings
18. Homes, Apartments, and Hotels
19. Churches
20. Radio Broadcasting, Television, and Sound-Recording Studios

There is no doubt that this book contains much of the minimum knowledge needed for any architectural acoustical consultant before acquiring any advance studies in acoustics and, just as important, before specializing in the practice under supervision of an expert in one or more areas of this encompassing field. Here are the chapter descriptions.

1. "Properties of Sound" starts with a short introduction of the basic terms of the sound phenomena and the building—what is sound, propagation of the sound displacement amplitude, the frequency, speed of soundwave, wave form acoustical power, sound intensity variation of pressure and intensity with distance, the decibel, sound level meters, directionality of sound sources, etc.

2. "How We Hear" discusses the ear structure and the hearing mechanism, the sensitivity of the ear, impaired hearing, loudness and loudness level, effect of noise on hearing, etc.

3. "Speech and Music" connects the basic terms of noise, music and speech, the speech power, properties of musical sounds, some effects of the room on speech and music, etc., to predict and control the behavior of speech and music in rooms and halls.

4. "Reflection and Diffraction of Sound in Rooms" discusses two major basic terms of room acoustics: the reflection of sound and the diffraction of sound in the room and their behavior in the room and produces the acoustical images.

5. "Open Air Theaters"—from the ancient Greek theater to the Roman with descriptions of the sound propagation in the air, speech articulation test in the open air, the design of open air theaters, the orchestra shells, etc.

6. "Sound Absorptive Materials" discusses how sound is absorbed, the rating of acoustical absorptivity of materials, prefabricated acoustical units, acoustical blankets, perforated facings, mounting acoustical materials, reflection of light from acoustical materials, effect of paint on absorption of sound by acoustical materials, absorption by patches of materials.

7. "Special Sound Absorptive Constructions"—panel absorbers, Helmholtz resonator absorbers, draperies, variable absorbers, and suspended absorbers.

8. "Principles of Room Acoustics"—one of the best in my mind, deals with some chosen principles of room acoustics, including those properties of sound we consider in design of open air theaters and addition principles of reflection, absorption and scattering of the sound and its boundaries of the enclosures, the room resonance, normal modes, sound pressure distribution, the diffusion of sound, the physical and geometry acoustics, the growth of sound in a room, steady-state value of sound pressure, decay of sound in a room, average decay rate, limitations on use of reverberation formulas, sound decay and reverberation time at different frequencies, effects of air absorption upon decay rate and reverberation time, reverberation time nomographs, reverberation in coupled spaces, special acoustical phenomena associated with the shape of rooms.

9. "Acoustical Design of Rooms"—the reader exposed to several practical aid conclusions to fulfillment as necessary acts in the planning process to rich good acoustics in a building begins with the selection of the building site and continues through 11 basic stages of designing. In the design process the reader must follow the 11 requirements to reach good acoustics. In those 11 requirements, we can find 4 requirements applicable to all rooms that are used for speech and music. These very detailed, specific, and practical requirements are highly important to every acoustical consultant. This chapter continues and deals in the rating of speech intelligibility–articulation testing, design of room shape, volume per seat, optimum reverberation in rooms, control of reverberation, checking the completed room, articulation testing and more with great imported data and examples.

10. "Noise Control"—the authors obliged the architect to seek for every possible means, any features to impart the building design and construction, for avoiding any effect of noise, base an intelligent approach and implement seven knowledge management rules. This chapter deals with the addition of noise levels, noise in buildings, outdoor noise, acceptable noise level in buildings, siting and planning to avoid of any effect of noise to avoid of any effect of noise against noise, grading and landscaping, building layout, etc.

11. "Reduction of Airborne Noise"—and ways to avoid failures in the design of the building including: how the sound is transmitted, transmission through openings, sound transmission loss, rigid partitions, porous materials, compound wall constructions, windows and doors,

noise insulator to avoid of any effect of noise insulation factor, noise insulation requirements, noise reduction by sound absorptive treatment, application of acoustical materials, and some useful tables of data, graphs, figures, and equations to calculate or evaluate the sound isolation, etc.

12. "Reduction of Solid Borne Noise"—which is considerably different from those of the airborne sound is described in a very simple common way, including special attention to the floors and ceiling, discontinuous construction, isolation of machinery vibration and some useful data tables, clear graphs and figures, and equations to calculate or evaluate the sound isolation, etc.

13. "Control of Noise in Ventilating Systems"—to ensure quiet operation free of annoying noise generated by or transmitted through the system. The chapter deals in origin of noise in ventilating systems, noise suppression in ventilating systems, acoustical materials for duct lining, calculation of noise reduction in lined ducts, acoustical filters, elimination of cross-talk, and it include few useful data tables, clear graphs and figures, and general equations to evaluate the sound isolation, etc.

14. "Sound-Amplification Systems" include basic and brief practical means for increasing the sound level in rear portions of a room. The chapter deals of the uses of sound amplification, the single-channel sound-amplification system, the microphones, required acoustical power, the loudspeakers, stereophonic sound systems, etc.

15. "Auditoriums" is a practical chapter based on the above major principles and recommendations. The chapter opens by describing the history of development of the auditorium, planning of the auditorium, the little theater, the legitimate theater, school auditoriums, civic auditoriums etc. This is a very practical chapter, although many years have passed since the book was written.

16. "School Buildings" is another very good chapter, although it was written more than 65 years ago, and it deals in some basic definitions, characteristics, and recommendations of the design of school rooms, like the layout of the school buildings, rooms that require acoustical designing, classrooms, lecture rooms, music rooms, gymnasium, cafeteria, library, offices, miscellaneous rooms, and corridors.

17. "Commercial and Public Buildings" is like the last two chapters, a very brief practical and recommendation chapter for implement in any commercial and public building. The chapter includes some introduction, and general discussions about the office, bank, and store buildings, libraries, clubs, and recreational buildings and museums, legislative, administrative, and judicial buildings.

18. "Homes, Apartments and Hotels"—some short practical guiding for homes, apartments, houses, and hotels.

19. "Church Buildings"—some basic preliminaries of basic guidelines and important practical recommendations for design small and large churches.

20. "Radio Broadcasting, Television and Sound-Recording Studios"—some basic and general guidelines for acoustical design.

Appendix 1. Seven different tables of detailed coefficients of sound absorption.

Appendix 2. Six different tables of sound insulation data.

Appendix 3. Several conversion factors and physical constants.

The book is highly recommended for all students, architects, or engineers who seek basic comprehensive architectural acoustics knowledge. Further, the book is important for an acoustical professional's bookshelf.

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Halls for Music Performance: Another Two Decades of Experience 1982–2002

Ian Hoffman, Christopher Storch, and Timothy Foulkes, Editors
Acoustical Society of America, Melville, NY (2003)
301 pp., hardcover, 56.00 USD
ISBN: 0-9744067-2-4

The book belongs to a series of poster books published by the Acoustical Society of America (ASA) and covers a legacy of a whole collective effort, mainly compiled from two sources: the earlier book, *Halls for Music Performance Two Decades of Experience 1962–1982* written about the same matter, and the experiences provided by the consultants that participated directly in the design of the music halls.

The volume is published by ASA as the result of the poster sessions sponsored by the Technical Committee on Architectural Acoustics (TCAA) and presented at the 141st ASA meeting in Chicago, June 2001, and 143rd meeting in Pittsburgh, June 2002.

The organization of *Halls for Music Performance* is logical and comprehensive. The essence of the book is chapters detailing the halls with subsequent sections giving halls indexed by location and by acoustical consultant, and a list of (some) halls not included.

The book, reflecting more than two decades of experience, constitutes the celebration and chronicle of the evolution of the acoustical design of music halls over 20 years, a book that any professional working in the acoustics field must read and have as a part of his or her library.

This interdisciplinary approach and highly collaborative effort starts with William Cavanaugh from the ASA encouraging poster sessions, followed by the acknowledgement of the contributors, the number of projects, the meetings organized by ASA, and the huge and personal effort of the authors.

The editors, Ian Hoffman, Christopher Storch, and Timothy Foulkes continue, complement, and honor the preceding works of Richard Talaske in *Halls for Music Performance Two Decades of Experience 1962–1982*, Michael Barron in *Auditorium Acoustics and Architectural Design*, David Bradley in *Acoustical Design of Theaters for Drama Performance: 1985–2010*, and certainly, Leo Beranek in Concert and Opera Halls, *How They Sound*.

The technical and architectural information contained in the book is by several contributors and includes drawings, color photographs and technical and physical data about 142 halls for music performance, located in 16 different countries, encompassing the work of 15 acoustic consultants.

Scrolling through the pages of the book is a journey crossing worlds among acoustics, architecture, and music hall design. A wonderful trip through four continents that is full of colors and depicted with high quality photographs, drawings, and relevant acoustical data. The variety of music halls: 80 from USA; 32 from Japan; 8 from UK; 3 from Canada and Peru; 2 from Australia, Denmark, Singapore, Spain, and South Korea; and finally, 1 from Brazil, Finland, France, Malaysia, Russia, and Switzerland, offers a sensation of vertigo due to the multiplicity of hall shapes, geometries, dimensions, uses, seating capacities, stage location, side wall materials, ceiling, balconies, drapery, etc.

It is very interesting to realize how acoustical design quality has been progressing in recent years and to discover the fundamental elements of such a transformation. I definitely agree with the editor's remarks that traditional well-founded methods have not been substituted but have been complemented, streamlined, refined, and augmented with new technological tools, and measurement and instrumentation methods. This is especially true in a transition from hand to computer drawings; physical scale modeling to prototype laser studies, 3D computer modeling for acoustic simulations or visualization, sightline and seat layout and size optimization, boundary and finite element analysis of walls and materials, and auralization; and from large analog equipment to small, fast, and multifunctional digital instruments.

It is refreshing to read and rediscover the richness of tools used in highly customized acoustic enhancement systems and acoustic adjustability, such as movable ceilings, coupled volumes, variable apertures, acoustic controlled moving banners, curtains, and panels.

It should be stressed that, including 142 music hall projects, with such widespread characteristics, implies an extraordinary effort to organize the acoustical data in a contrastable way, particularly considering that they come from different information sources, so the objective and subjective tests are precisely designed to evaluate and compare different acoustical spaces, and is still a field that requires a tremendous work. Perhaps that is why the acoustic information included in the book has been presented with a very conservative approach, almost reduced to the very basic magnitudes of reverberation time and background noise; and going further to Early Decay Time, Clarity *C80* or *C50*, Sound Strength *G*, Lateral Fraction, *LEVcalc*, or Interaural Cross-Correlation *IACC* in a few cases.

Taking for granted that one of the primary purposes of the book is to serve as a reference for acoustical designers, consultants, and students of architectural acoustics, the goal is successfully achieved thanks to the quality, quantity, and how authors systematized the information presented.

I deeply enjoyed reading this book. The pictures, starting with the cover image, are just fantastic. The vast amount of information presented by the contributors and synthesized by the editors has no waste at all. By reading this book, definitively is an invitation to continue traveling along the Poster Collections Series of the ASA books.

The book is a must referent for both students and acoustics professional consultants involved in the design of concert halls.

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ROCKFON Presents Designing with Metal Ceilings AIA/CES Educational Course

* News release – view online – Images available *

Chicago — "Designing with Metal Ceilings" is an educational course from ROCKFON for architects, designers and other building team professionals seeking to expand their knowledge and create beautiful, high-performance, effective ceiling designs. Please email cs@rockfon.com, call 800-323-7164, or click here to find a ROCKFON representative to share this one-hour, in-person presentation.

Led by a ROCKFON representative, "Designing with Metal Ceilings" teaches participants about the:

- Benefits of suspended ceilings, such as aesthetics, easy maintenance, sustainability attributes, optimized acoustics and other high-performance advantages
- Design considerations with metal ceilings, such as aluminum or steel construction, suspension systems, sizes, shapes, perforations and finish options
- Budget, schedule and installation considerations of metal ceiling designs
- Specification considerations of metal ceilings, such as recycled content, industry installation guidelines, international and local code requirements, and ASTM performance standards
- Standard and unique project applications for common metal ceiling systems, such as exposed or concealed suspension systems, open cell, security, curves, clouds and perimeter trims

This educational course is approved for credit through the American Institute of Architects' Continuing Education Systems (AIA/CES), the Green Building Certification Institute representing LEED® certification for the U.S. Green Building Council (GBCI/USGBC) and the Interior Design Continuing Education Council (IDCEC). Equivalent credits also may be available from other professional associations.

"With in-person presentations, attendees have the opportunity to ask general questions, as well as to address specific issues for their commercial building projects and local geographies," says Chris Marshall, ROCKFON vice president of marketing.

He continues, "As part of our complete ceiling solutions, ROCKFON offers the largest variety of specialty metal ceiling panels in the industry. Our metal panel products come in a wide range of shapes, sizes and finishes, in standard and custom configurations. ROCKFON metal panels and stone wool acoustic ceiling panels are engineered for easy installation with Chicago Metallic suspension systems." An overview of the company and its products also is featured with the presentation.

ROCKFON metal ceiling panel systems include:

- ROCKFON Intaline™ round-base or v-base metal baffle ceilings
- ROCKFON CurvGrid™ one- or two-directional curved ceiling systems
- ROCKFON CurvGrid™ curved ceiling system with EZ-Flex™ panels
- ROCKFON Planar® PlanarPlus® or PlanarMacro™ MacroPlus™ linear ceilings
- ROCKFON BeamGrid™, CubeGrid™ or Magna T-Cell™ open plenum ceiling systems
- ROCKFON GraphGrid™ open plenum wire panel and MetalScapes™ wire mesh panels
- ROCKFON Planostile™ lay-in or snap-in metal panel ceiling system
- ROCKFON SpanAir™ clip-in or torsion spring concealed metal panels
- ROCKFON SpanAir™ plank hook-in or hook-on metal ceiling systems
- ROCKFON Traditions™ embossed metal cornices and panels
- ROCKFON Metaline™ lock-in and Secureline® plank acoustical security ceiling systems
- ROCKFON Infinity™ perimeter trim options

More information about these ROCKFON metal ceiling panels, stone wool panels and suspension systems, and educational courses, is available at http://www.rockfon.com. For additional support, please email cs@rockfon.com or call 800-323-7164.

For more information, visit www.rockfon.com; Media Contact: Heather West, 612-724-8760, heather@heatherwestpr.com; Follow the links to view online or to download Word document and Photo

ROCKFON Optimized Acoustics Expands Technical Resources Addressing Room-To-Room Sound Blocking

* News release – view online – Images available – Exhibiting at INTEX #1119 and at AIA in #1223 *

Chicago — Helping architects, designers and other building team professionals to effectively manage noise and privacy between rooms, OptimizedAcoustics.com

shares new technical resources from ROCKFON in an expanded and enhanced online experience. This updated interactive content is complemented with a new publication, "Optimized Acoustics™: Your Guide to Sound Blocking Design Solutions."

"Now more than ever, an optimal acoustic experience is as important as the look, feel and function of a space," says ROCKFON acoustic specialist, Gary Madaras, PhD, Assoc. AIA. "It's important to consider how every structure, surface, fixture, material and even gap plays a role in the way noise is experienced. To achieve the best sound experience at the best price, use ceiling systems to optimize sound absorption and, where needed, use walls or plenum barriers to effectively block sound between rooms."

Visitors to OptimizedAcoustics.com now can use the online tools to assess the level of noise in adjacent rooms and the level of sensitivity to noise and then to select, good, better and best solutions for achieving sound blocking levels of Sound Transmission Class (STC) 40, 45 and 50.

Most acoustics standards, guidelines and building rating systems require blocking levels of STC 45 or higher for offices, patient rooms, classrooms and other rooms in commercial spaces. A sound blocking level of STC 45 means that a listener in a quiet room would hear raised speech in adjacent rooms, but would not be able to understand the conversation.

Full-height interior walls can achieve STC 45 or higher. If full-height walls are unavailable or impractical, a lightweight plenum barrier positioned vertically above the wall can provide an STC 40, 45 or 50 level of blocking when combined with a stone wool ceiling system. This can decrease the cost of the ceiling, allow for greater layout flexibility in the future and prevent the need to control noise leaks through the ceiling system.

Beyond the new content on sound blocking, returning visitors to OptimizedAcoustics.com also will notice a streamlined, more efficient, user-friendly flow, plus improved auditory demonstrations and interface. Information will continue to be added to help visitors achieve the best sound experience at the best price by using ceiling systems to optimize sound absorption and, where needed, using walls or plenum barriers to effectively block sound between rooms.

To download a copy of "Optimized Acoustics: Your guide to sound blocking design solutions," please visit http://OptimizedAcoustics.com. To learn more about ROCKFON stone wool panels, metal ceiling panels and suspension systems, please visit http://www.rockfon.com. For additional support, please email cs@rockfon.com or call 800-323-7164. *Media Contact: Heather West, 612-724-8760; heather@heatherwestpr.com; Follow the links to view online or to download Word document and Photo 1, Photo 2 and Photo 3.*

About the ROCKFON Business

The ROCKFON business is a leading provider of acoustic stone wool and metallic ceiling solutions and suspension systems.

With the acquisition of Chicago Metallic Corporation Inc., the ROCKFON business provides customers a complete ceiling system offering combining stone wool and specialty metal ceiling panels with Chicago Metallic suspension systems.

ROCKFON complete ceiling systems are a fast and simple way to create beautiful, comfortable spaces. Easy to install and durable, they protect people from noise and the spread of fire, while making a constructive contribution toward a sustainable future.

The ROCKFON business is a subsidiary of Denmark-based ROCKWOOL International A/S, the world's largest producer of stone wool products. ROCKWOOL International A/S is listed on the NasdaqCopenhagen stock exchange. More than 10,000 people in 37 countries are employed within the ROCKWOOL Group.

In North America, the ROCKWOOL Group operates under the name ROXUL Inc, ROCKWOOL®, ROXUL® and ROCKFON® are all registered trademarks of ROCKWOOL International A/S.

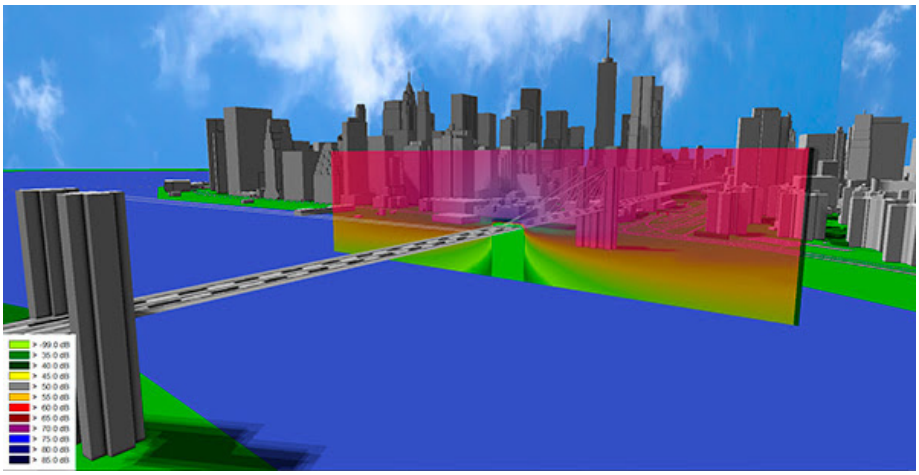
NEW CadnaA and CadnaR Environmental and Interior Noise Prediction Software

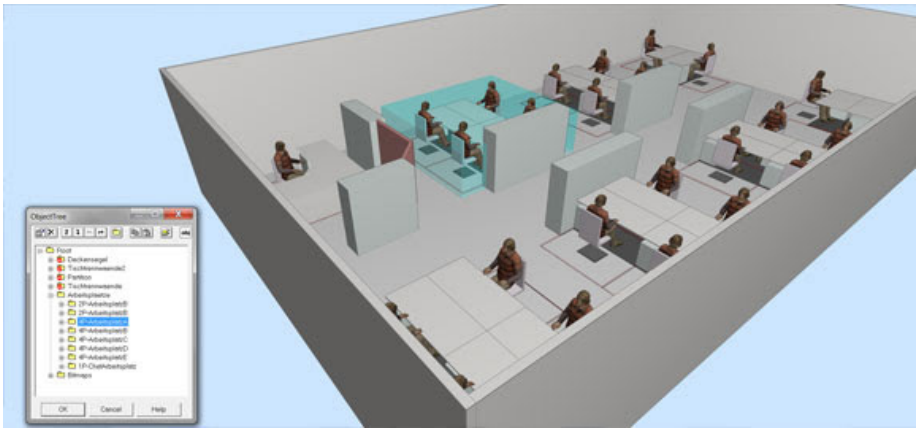
CadnaA Version 2017 Available Now

New version of DataKustik's CadnaA state-of-the-art software for environmental noise prediction is now available with a list of new features, including:

- CNOSSOS-EU 2016 standards implemented
- Save grid calculations for all variants within the same project
- New Plot-Designer featuring free moving containers
- Animation of 3D Models in the 3D - Special view
- Redesigned Plot-Designer
- Import from OpenStreetMap and SketchUP and more

Video highlighting the new features can be viewed here.





For more information or to download a free demo version, please visit DataKustik's website.

CadnaR Version 2.5 Available Now

CadnaR is the efficient and easy to use software to accurately assess occupational noise and optimize the sound quality within rooms. New features in v2.5 include:

- New grouping system to easily copy, paste and edit groups of objects
- Display and move the ObjectTree groups in 2D and 3D
- New context actions available for objects
- Improved automatic configuration settings for particle calculations
- Extended database of absorption and more

Video highlighting the new features can be viewed here.

For more information or to download a free demo version, please visit DataKustik's website.

About Scantek

Scantek, Inc. is a worldwide leader in sound and vibration instrumentation sales, service, rental and calibration. Scantek sells, services, and rents the finest products and provides expert support on their use. The Scantek Calibration Laboratory is accredited for microphones, calibrators, sound level meters, dosimeters, sound and vibration FFT and real-time analyzers, preamplifiers and signal conditioners, accelerometers, velocity sensors, vibration meters and vibration exciters. Scantek, Inc is a wholly owned subsidiary of Norsonic AS.

NEW EDM Modal: Complete Modal Testing & Analysis Suite February 2017

CRYSTAL INSTRUMENTS

Introducing EDM Modal: Complete Modal Testing & Analysis

EDM Modal is a complete Modal Testing and Modal Analysis suite for Experimental Modal Analysis (EMA). EDM Modal was developed based upon the sophisticated technologies of modern modal analysis theory and technique. With its intuitive controls and powerful features, EDM Modal is the ultimate tool for modal analysis applications. An intuitive interface allows users to manage highly complicated tests that can involve hundreds of measurement points and multiple excitations. This interface also allows for simple tests to be conducted quickly and with little effort. Regardless of how complicated the modal test is, EDM Modal provides exactly the right tools to achieve your goal.

EDM Modal supports the following applications:

- Geometry creation/import/export/animation
- Operational Deflection Shape analysis
- Impact hammer modal testing
- Single or multiple shaker modal testing
- Single reference modal analysis
- Poly-reference modal analysis
- Reporting to Microsoft Word

Visit Website

TNM 3.0 Problems from the SoundPLAN Perspective

The Federal Highway Administration has announced that the long awaited draft revision of the TNM 3.0 software will be released in the near future. We take this opportunity to document known problems that are still associated with the new software's noise calculation core. The users of the TNM 3.0 software expect that the software is compliant with the physics and fully consistent with the written standard of TNM and free of calculation errors and random fluctuations of the results. At the moment this unfortunately is not the case.

SoundPLAN is the market leader of noise simulation and modeling software with more than 5000 licenses in worldwide use. SoundPLAN is a standards based software with over 75 standards implemented for road, railway, industry and aircraft noise. Users in the USA, Canada and other countries are interested in a fully tested version of the TNM algorithms. In the USA in particular consultants want to use SoundPLAN on Federal Aid projects and many other multiple source type projects (car wash, trucking facilities, warehouse operation, truck stops, container terminals, retail delivery, residential developments, park and ride places, stadiums) that are not co-financed by Federal dollars. It is absolutely necessary that the results for these studies deliver the same results for the road part in SoundPLAN as the noise study for the main road that may be a Federal Aid project calculated with the TNM software.

Many of these noise modeling projects involve multiple noise types such as road, railways and industrial sources and require different types of noise maps to be generated. TNM is designed for road noise only and therefore does not support comprehensive noise models with multiple noise types. So far the scope of TNM is limited to stand alone receivers, in SoundPLAN we have this option but offer various types of noise maps such as Grid Noise Maps, vertical Cross-Sectional Grid Noise Maps and Façade Noise Maps. For the assessment of noise barriers, we offer true barrier optimization for multiple receivers and also for entire neighborhoods in the form of Façade Noise Maps. Noise contours much better depict the noise situation of a project and also reveal much more about the consistency of the modeling software than the numerical results can.

Since the late 1990s, SoundPLAN has implemented the US regulations such as Stamina, TNM and the FRA railway model. For the past 17 years SoundPLAN has been working on the implementation and testing of the TNM algorithms. When we analyzed the TNM program code, we found several shortcomings and bugs in the software and notified the FHWA about them. The request from SoundPLAN and others to receive equivalency status was met with the Consistency Test Suite for the FHWA TNM. It is great to have official test questions, the master results and an acceptable margin of error to systematically test all components of the simulation.

Testing software is always best when comparing the results either directly to hand calculations based on the standards document or comparing the results to third party software. Both methods ultimately reveal systematic errors and shortcomings in the software. Mapping the numerical results in a graphic also shows where the software development traded speed for consistency of the results. With SoundPLAN we can graphically show where the TNM 3.0 software still has problems that

make the results fluctuate beyond the allowed margin of error. We tested the SoundPLAN software against TNM 3.0, having access to the source code we could not only compare the results but to a limited extent also check what/if scenarios by modifying the TNM code itself. In the process of comparing results and finding the root cause of the differences, we improved the compliance of SoundPLAN but we also found mistakes in the TNM software. The errors we found in the first three chapters of the Consistency Test Suite does not allow us to continue testing the additional chapters as we cannot be certain about the cause of the deviations, known errors revealed from first three chapters or additional errors in either SoundPLAN or the original TNM software.

As an ISO 9000 certified company involved in the development of the ISO 17534 "Acoustics – Software for the calculation of sound outdoors / Quality requirements and quality assurance," SoundPLAN GmbH is interested in supplying a fully quality tested product based on fully tested and verified standards. We also are sure that users of the TNM 3.0 expect software fully consistent with the written standard of TNM and free of calculation errors and random fluctuations of results. Known problems with the TNM calculation kernel should be rectified before users produce wrong answers. With an updated TNM 3.0 model and an updated TNM 3.0 Consistency Test Suite, we can proceed with our testing and make sure that SoundPLAN users get a fully tested and verified product. This e-mail was sent to you to raise awareness of the TNM 3.0 problems so that you can ask the FHWA and Volpe Center how TNM 3.0 results fits with the Consistency Test Suite. For a full review of the known TNM problems, please click the link below to open the PDF file.

Click here to read details about the TNM errors and problems found in the first 3 chapters of the Consistency Test Suite.

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Below is a list of international contacts for the advertisers in this issue. The telephone number is followed by the fax number where available. In cases where there are two or more telephone numbers per location, or several locations within a country, a semicolon (;) separates the telephone number(s) from the respective fax number. Advertisers are asked to send updated information by e-mail to cathy@inceusa.org.

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Below is a list of congresses and conferences sponsored by International INCE and INCE-USA. A list of all known conferences related to noise can be found by going to the International INCE website on the Internet (www.i-ince.org).

June 12–14, 2017
NOISE-CON 2017
Noise Control Engineering Conference
(with SAE Noise and Vibration Conference)
Grand Rapids, Michigan, USA
noisecon17.inceusa.org

August 27–30, 2017
INTER-NOISE 2017
2017 International Congress on Noise Control
Hong Kong, China
http://www.internoise2017.org/

August 26–30, 2018
INTER-NOISE 2018
2018 International Congress on Noise Control
Chicago, Illinois, USA
https://inceusa.org/conferences/internoise-2018-chicago-il/

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