

NOISE/NEWS

INTERNATIONAL

Volume 25, Number 3
2017 September

*A quarterly news magazine
and online digital blog published
by I-INCE and INCE-USA*

■ Meet the New Managing Editor

■ Exciting Changes Coming for NNI

■ The Institute of Acoustics

■ NOISE-CON 2017 Report



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

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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.

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NOISE/NEWS

I N T E R N A T I O N A L

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

This is the first issue of *Noise/News International* (NNI) for which I will serve as managing editor. I'm delighted to take on this new role and look forward to continuing the fine work of Jim Thompson and George Maling. Jim has been an invaluable resource in the transition and I wish him all the best in his new role as managing editor of the *Noise Control Engineering Journal*.

Please allow me to briefly introduce myself. As a professor at the University of Hartford, Connecticut, I work in the acoustics program and lab. Prior to coming to the United States in 2013, I conducted research out of Trinity College Dublin, Ireland, and carried out consultancy work in the area of environmental noise control. My primary research area is the management and control of environmental noise, particularly in the development of novel noise mapping strategies. My work on environmental noise has introduced me to a broad range of research areas and developed my interest in all areas of acoustics and noise control. As a member of the CNOSSOS-EU Technical Forum of Experts (a group charged with the development of a common method for noise assessment in the EU) and an INCE-USA board member, I have been struck by the diverse and exciting research being carried out in the field of acoustics and noise control, both in Europe and the United States. I relish this opportunity

to understand, in an in-depth way, and share the work being carried out across the 40-plus I-INCE Member Societies across the world.

Over the coming months a few exciting changes are happening with *Noise/News International*. The transition to a blog will continue, and we are developing our social media presence. I encourage you to follow and interact with us on Facebook and on Twitter (@NNIEditor). Our goal is to publish noise news and information as it becomes available, allowing our subscribers to stay up to date on all developments in the field. By building the presence of both our publication and community online, we hope that NNI will become the first stop for anyone interested in news and information about noise control across the globe.

That being said, I'd like to take this opportunity to welcome news and information from anyone in the noise control community. Your contributions are vital to the success of NNI. Topics of interest range from research news, product news, case studies, conference reports, and all other aspects of the profession. All input is welcome!

Thank you for your support and continued readership of this important publication. Feel free to reach out to me directly—I am happy to discuss all things noise. I sincerely hope you enjoy this issue of NNI. 📧



Eoin King, PhD

The advertisement features the Odeon logo on the left, which consists of three concentric white arcs and the word "Odeon" in a white sans-serif font, with "Room Acoustics Software" in a smaller font below it. To the right of the logo are several 3D-rendered acoustic diffusers. The background is a dark, high-contrast image of a modern interior space with large windows and a wooden bench. A red horizontal bar at the top right contains the website address "www.odeon.dk" in white text. Below the logo, the text "... brings measurements and simulations together" is written in a large, white, bold, sans-serif font.

The Institute of Acoustics—Always Ready to Tread the International Stage



The Institute of Acoustics (IOA)—the UK’s professional body for those working in acoustics, noise, and vibration—has been celebrating the successful staging this summer of one of its biggest ever international conferences. The 24th International Congress on Sound and Vibration (ICSV24), which the IOA organized on behalf of the International Institute of Acoustics and Vibration (IIAV), attracted more than 1,000 delegates from 54 countries around the world to London in July. The event, covering the whole spectrum of acoustics and vibration, was the first major international congress to be held in the

UK capital since the 1974 International Congress of Acoustics.

The scientific program presented a huge organizational challenge. Featuring more than 932 papers, including 135 posters, it was structured into 16 themes. Each theme contained structured and regular sessions, with papers presented in the 17 rooms of the congress venue and organized in parallel sessions corresponding to the subject areas.

Since its formation in 1974, the IOA has gained a worldwide reputation among acousticians for its mastery in the organization of big international events. ECUA (European Conference on Underwater Acoustics), Euronoise, IC BEN (International Commission of the Biological Effects of Noise), and



Jérémie Voix delivering one of the plenary lectures

INTER-NOISE and are just some of the conferences etched on its “roll of honor.”

And although the dust has barely settled on ICSV24, plans are already well advanced for two more large events in 2018: the 4th International Conference on Synthetic Aperture Sonar and Synthetic Aperture Radar in Lerici, Italy, on September 5–7, and the 10th International Conference on Auditorium Acoustics, which is to be held at the recently opened and much-acclaimed Elbphilharmonie in Hamburg on October 4–6 and supported by the German Acoustical Society (DEGA).

Before that, the Institute will stage the 33rd incarnation of Reproduced Sound—subtitled Sound Quality by Design—in Nottingham on November



IOA President, Jo Webb, at the opening of ICSV24

21–23, and its annual conference, Acoustics 2018, in Cardiff on April 23–24. It could be said the IOA’s “conference wheel” never really pauses, even for a brief moment.

IOA membership has grown steadily since its creation and is now approaching the 3,400 mark, with members ranging from acoustic consultants to students, and from academics and researchers to central and local government officers. To cater to their interests, the Institute has nine specialist interest groups and 11 regional branches that, between them, organize a series of regular meetings throughout the year.

As a registered charity, the Institute has a special commitment to education and as such offers a range of highly regarded courses across the UK and in Ireland. Its “flagship” is the Diploma in Acoustics and Noise Control, which is now widely established as the leading specialist qualification for the professional practitioner in acoustics. Normally studied over a year, it is available at accredited centers or—and this is an increasingly popular choice among overseas students—via tutored distance learning, which offers a Skype option for those unable to attend monthly tutorials. Also offered are short certificate courses in building acoustics, environmental noise measurement, management of occupational exposure of hand-arm vibration (HAVS), and workplace noise risk assessment.

As an accredited body with the UK’s Engineering Council, the Institute is able to offer a route to Chartered and Incorporated Engineer status, and currently has some 310 members who have achieved chartership.



ProPG: Planning & Noise

Professional Practice Guidance on Planning & Noise

New Residential Development

May 2017



Chartered Institute of Environmental Health



In addition to the ICSV24 success, the Institute has recently published much-acclaimed guidance on a recommended approach to the management of noise within the planning system in England, which it hopes will eventually be endorsed by the UK Government. Entitled *Professional Practice Guidance on Planning and Noise (ProPG)*, the document was produced with the Association of Noise Consultants and the Chartered Institute of Environmental Health.

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NOISE-CON 2017 Report



NOISE-CON 2017, the 2017 National Conference and Exposition on Noise Control Engineering, was held on June 12-14, 2016, in Grand Rapids, Michigan, USA.

One hundred sixty-five (165) technical presentations were given at the conference. The one hundred forty-seven (147) papers along with other information about the conference were distributed to the 244 attendees on a thumb drive. It must be noted that this attendance does not include the exhibitors since they were administered by SAE (Society of Automotive Engineers). If the exhibitors were added in, the total attendance would be approximately 350. Jim Thompson served as General Chair; Hether Fedullo served as Vice Chair; and Gordon Ebbitt, Steve Sorenson, and Yong-Joe Kim served as Co-Technical Chairs. Gordon Ebbitt served as the Proceedings Editor. Dana Lodico served as the Student Activities Chair.

This was a unique NOISE-CON in that it was co-located with the 2017 SAE Noise and Vibration Conference and Exhibition. The goal of this co-location was to provide the opportunity for attendees of these conferences to see both wider and more specialized applications of noise control engineering. With an attendance of 1,103, the SAE conference made for a significantly larger combined conference. The SAE conference focused on the

mobility industry with 149 papers on automotive, truck, aerospace, and off-highway noise control. The exhibition was administered by SAE with 119 exhibitors.

In discussions with attendees during the conference and a discussion with SAE International after the conference, there was universal agreement that the co-location of these conferences was a great success. Also, all those consulted asked that this be done again as a service of high value to attendees and both SAE and INCE-USA members. SAE suggested that they would be pleased to have this co-location every four years, the SAE conference is held every other year.

An important feature of this co-located conference was the organization of two special technical session groups. A set of joint sessions was organized with both SAE and INCE-USA participation to bring together outstanding complementary papers from both organizations on topics of interest to both sets of attendees. In addition, these sessions were open for attendees from both conferences. The topics of these joint sessions are listed below.

1. Lightweight Vehicle Construction Acoustic Design
2. Artificially Generated Noise in Vehicle Interiors and Sound Quality Considerations

3. Product Development Methods: Cross-Disciplinary Tools and Processes for Delivering NVH Attributes
4. Aerodynamic Noise Prediction and Validation
5. Hybrid/Electric and Electric Vehicles—Consequences of Minimum Sound Regulatory Requirements
6. Aircraft Interior Noise

These sessions were highly successful with good attendance and participation.

The second special grouping of sessions was the group of automotive sessions in the NOISE-CON program. Perhaps due to the location of this conference, within two hours of Detroit, and the co-location with the SAE conference there was a particularly large number of automotive-related papers submitted. These automotive sessions, although organized by INCE-USA, were open to SAE attendees as well. There were four such sessions that were again quite successful in terms of participation and attendance.

In addition to the presentations of the technical papers at the conference, there was a special session honoring the life and achievements of Leo Beranek (see Figure 1). The sessions organized by George Maling and Eric Wood was both informative and thought provoking. The unique nature of Leo and his contributions were outlined by a series of outstanding presentations. The session was well attended and provided an outstanding memorial to Leo and his leaderships in the development of INCE and the field of noise control engineering.

There were also four short courses offered to those who attended the conference:

LEO BERANEK MEMORIAL SESSION

Monday, June 12
1:30 pm – 5:30 pm



Figure 1. Leo Beranek Session Poster

- INCE Fundamentals Exam Prep Course
- Acoustic Design of Mufflers, taught by Tamer Elnady, Ph.D., Professor of Engineering at Ain Shams University, Cairo, Egypt, and Daniel J. Kato, an acoustical consultant in San Jose, California
- Practical Aspects of Acoustical Enclosure Design, taught by David Herrin, Associate Professor in Mechanical Engineering, University of Kentucky, and Daniel J. Kato, an acoustical consultant in San Jose, California

- Sound Intensity Measurements for Noise Control, taught by Steven Jorro, E-A-R Thermal Acoustic Systems

As has been done in recent NOISE-CON conferences, an app was used to provide attendees with a detailed schedule, session information, maps, and timely updates on events and issues. This app was developed by SAE International, but covered both conferences so that all attendees could see the many sessions going on simultaneously.

Monday, June 11, 2017

The opening events for the conference were held on Monday, June 11. At this

early morning session, Jim Thompson welcomed everyone to NOISE-CON 2017 and recognized the organizational team who had put together the conference. Rick Kolano, INCE-USA President, thanked Jim and the team and provided an overview of INCE-USA and encouraged members to participate in the Institute and contribute to the noise control engineering profession. The opening plenary presentation was provided by James Barnes of Accentech, Inc. (see Figure 2). James was honored in 2016 with the INCE/NCAC Laymon N. Miller Award for Excellence in Acoustical Consulting. His presentation “Career Lessons Learned from Laymon Miller and Others” was an interesting review of his career and the important lessons he had learned from his mentors.

The technical sessions began right after the plenary session with six parallel sessions. The SAE conference did not begin until Monday afternoon with workshops. The official opening of the SAE Noise and Vibration Conference was on Tuesday morning. As noted above, the Leo Beranek Memorial Session was held on Monday afternoon.

The exposition opening reception was held Monday evening. This was a joint reception with both SAE conference and NOISE-CON attendees. The attendance was quite large with the 1,103 SAE conference attendees added. With 119 exhibitors there was much for the attendees to see in touring the exhibit space. The exhibit area was large and with an excellent arrangement. There was good traffic and little congestion to impede people’s ability to visit the displays.

Tuesday, June 12, 2017

The Women in Noise Control Engineering Breakfast was held on Tuesday morning. Despite the early hour there was a good turnout with roughly 40 attendees. This event was sponsored by the Ford Motor Company and Scantek, Inc., and hosted by Patricia Davies. This meeting provided a



Figure 2. James Barnes Opening Plenary



Figure 3. Chad Musser, SAE Conference Chair



Figure 4. Jim Thompson, NOISE-CON 2017 Chair

forum for women in the field to share their experiences with each other and talk about ways to increase the number of women participating in noise control engineering. This was an excellent opportunity for networking and an exchange of information about careers in the field and future opportunities.

The sessions began with the opening session for the SAE Noise and Vibration Conference. Both NOISE-CON and SAE attendees were invited. The two conference chairs, Chad Musser for the SAE Conference and Jim Thompson for NOISE-CON, gave brief opening remarks (see Figures 3 and 4). Following this, Ahmet Selamet was named the 2017 SAE Ralph Hillquist Lifetime Achievement Award winner by Jim Thompson. Dr. Selamet has had a distinguished career at Ohio State University and has an outstanding record of research and teaching in automotive related noise control. Ahmet provided an excellent keynote talk, "Flow Instabilities and Sound: From Turbochargers to Wind Instruments." This was an outstanding presentation with video illustration of compressor stall (see Figure 5).



Figure 5. Ahmet Selamet Delivering Tuesday Keynote at SAE Opening

Following this plenary, there was a full slate of technical sessions underway for both conferences and the exhibitions opened immediately after the opening session.

At noon there was a combined SAE and NOISE-CON Speed Mentoring Session for Young Professionals. This event provided an opportunity for small groups (from 1 to 3 individuals) to sit with professionals in noise control to briefly discuss whatever topics they wished. There was a good turnout for this activity and all who participated indicated it was both rewarding and successful.

Wednesday, June 14, 2017

The first event Wednesday morning was the student breakfast sponsored by the National Council of Acoustical Consultants (NCAC). This event was well attended despite the early hour for students. This provided an excellent opportunity for students to talk with noise control professionals and discuss their career options.

The sessions began with Gordon Ebbitt introducing the plenary lecture by Dr. Rich DeJong of Calvin College (see Figure 6). Dr. DeJong's presentation "Measuring and Modeling Wind Noise" was an excellent discussion of this difficult topic and the contributions from the turbulent boundary layer and vortex shedding to vehicle interior noise. He provided an overview of the various contributions and made a difficult topic much easier to comprehend.

This presentation was followed by the INCE-USA awards ceremony with the ceremony conducted by Yong-Joe Kim and Jeff Fullerton (see Figures 7 and 8). At this ceremony, several student and professional awards were given. These included three travel awards, two presentation awards, and recognition of the 2017 Beranek Medalists. All funding for these awards was provided by the INCE Foundation, including some funds from directed donations.



Figure 6. Wednesday's Plenary Speaker Rich DeJong

Professional Awards

- Martin Hirschorn IAC Award—Best Paper Prize

This prize is funded by the INCE Foundation to recognize the best published paper within the preceding two years on new and/or improved cost-effective noise control and/or acoustical conditioning products.

The winning entry for this award was *Characterization of Sound Power Level Spectra Produced by HVAC Chillers with Double Helical Rotary Screw Compressors under Various Operating Conditions*. The author is Dan Hemme, The University of Texas at Austin.

Student Awards

Student Paper Competition—2017 Winners

Five awards were selected among 12 entries based on the peer reviews of papers and presentations. \$1,000 was awarded to each winner, \$500 for subsequent



Figure 7. Yong-Joe Kim Introducing Award Winners



Figure 8. Jeff Fullerton Introducing Award Winners

publication in NCEJ with the recognition as a Student Paper Competition winner. Funding was provided by INCE Foundation. 2017 was the 29th competition. The 2017 winners were:

1. Trinoy Dutta, Michigan Tech University, *Performance of Hard Disk Drives in High Noise Environments*
2. Weonchan Sung, Purdue University, *Descriptors of Sound from HVAC&R Equipment*
3. Micaela M. Thiery, Michigan Tech University, *Use of CNT Thin-film Assemblies as Microphones through Hot-film Anemometry*
4. Maxwell Toothman, Georgia Institute of Technology, *Performance Evaluation of a Syntactic-Foam Water Hammer Arrestor*
5. Nan Zhang, University of Kentucky, *Notes on Scale Modeling of Acoustic Scattering Problems*

Classic Papers in Noise Control Engineering Competition

In NOISE-CON 2017, among 8 applications, 1 winner was selected with a cash prize of \$1,000. Funding was provided by INCE Foundation. 2017 was the 6th competition. The 2017 winner was:

Yutong Xue, Purdue University, *Overview of J. B. Moreland's 1976 Paper on: Controlling Industrial Noise by Means of Room Boundary Absorption*

Leo Beranek Student Medal for Excellence in the Study of Noise Control

This award consists of an engraved medal and certificate of recognition to one undergraduate and one graduate student nominated by a North American institution. Funding provided by INCE Foundation. 2017 was the 7th year of the award. The 2017 winners (7 undergraduate and 5 graduate students) were:

1. Caleb B. Goates, Brigham Young University, Undergraduate (Bronze)
2. Stephania Vaglica, Michigan Tech University, Undergraduate (Bronze)
3. Weimin Thor, Purdue University, Undergraduate (Bronze)
4. Lauren Seibert, University of Cincinnati, Undergraduate (Bronze)
5. Anna Elefante, University of Hartford, Undergraduate (Bronze)
6. Lucas Shearer, University of Hartford, Undergraduate (Bronze)
7. Brenna Boyd, University of Nebraska, Lincoln (Bronze)
8. Blaine M. Harker, Brigham Young University, Graduate (Pewter)
9. Mahsa Asgarisabet, Michigan Tech University, Graduate (Pewter)
10. Rui Cao, Purdue University, Graduate (Pewter)

11. Gil Jun Lee, University of Cincinnati, Graduate (Pewter)

12. Kangping Ruan, University of Kentucky, Graduate (Pewter)

Undergraduate Student Project Award

This awards \$1,000 to cover project costs of an undergraduate noise control study not normally covered by university sources. An awardee needs to provide a report to INCE on project completion. Funding provided by the INCE Foundation. The target is two awards per year. The 2017 winner was:

Weimin Thor, Purdue University

Michiko So Finegold Award

Larry Finegold made a generous donation to the INCE Foundation from the Michiko So Finegold Memorial Trust. It is open to graduate students and young professionals studying noise effects research, development of noise policy, and related aspects of noise control engineering. 2017 was the 5th year of the award. Five awardees were selected for NOISE-CON 2017. Each award was \$1,000. The 2017 Michiko So Finegold Travel Award winners were:

1. Kangping Ruan, University of Kentucky, Graduate
2. Keyu Chen, University of Kentucky, Graduate
3. Seongil Hwang, Texas A&M University, Researcher
4. Jungdong Li, University of Kentucky, Graduate
5. Weonchan Sung, Purdue University, Graduate

Hallberg Foundation Award

Doug Winker made a generous donation to the INCE Foundation from the Elizabeth L. and Russell F. Hallberg Foundation. This travel award is open to undergraduate and graduate students attending and presenting

at NOISE-CON or INTER-NOISE. Seven awardees were selected for NOISE-CON 2017. Each award was \$860. The 2017 Hallberg Foundation Travel Award winners were:

1. Mahsa Asgarisabet, Michigan Tech University, Graduate
2. Miles Penhale, Michigan Tech University, Graduate
3. Micaela Thiery, Michigan Tech University, Graduate
4. Suraj Prabhu, Michigan Tech University, Graduate
5. Siddharth Parmar, Michigan Tech University, Graduate
6. Nan Zhang, University of Kentucky, Graduate
7. Mohammad Gholami, Sherbrooke University, Graduate

Following the awards presentation, Rick Kolano, INCE-USA president, thanked all the participants and noted what a successful conference this had been. The conference chair, Jim Thompson, thanked the conference-organizing team, the authors, the exhibitors, sponsors, and the team from SAE International for making this such a successful co-located conference. Chad Musser and Bryce Gardner, chairs of the 2019 NOISE-CON conference in San Diego, provided a brief overview of the upcoming conference and invited all to attend. Charles Moritz, chair of the 2018 INTER-NOISE conference, provided a comprehensive presentation on the plan for this conference in Chicago.

An important event held on Wednesday afternoon was the Young Professionals and Student Workshop. This was a two-hour block of time containing a meet and greet with INCE-USA directors and officers, SAE International Staff and Officers, presentations on a number of

topics and open discussions, and one-on-one discussion opportunities. Steve Sorenson and Jim Thompson organized an outstanding session that was well attended and provided a great opportunity for young professionals to learn about INCE, get some guidance from seasoned professionals, and network with each other. The topics presented are shown below.

- Introduction of Officers and Committee Members, Dana Lodico, INCE-USA; and Melissa Jena, SAE International
- Presenting a Conference Paper, Stuart Bolton
- SAE Committees Presentation, Marc LeDuc
- INCE-USA Technical Committees, Gabriella Cerrato
- SAE Journals, Peijun Xu
- NCEJ Presentation, Jim Thompson
- Open Discussion, All

This event was followed by a technical tour of the Calvin College laboratories to see their test facilities and the student projects being carried out in noise control and other topics. This event was well received with good attendance.

The NOISE-CON conference ended at this point with both technical sessions and the exhibition closing down. However, the SAE Noise and Vibration conference carried on until noon on Thursday. On Thursday, SAE held a wrap-up meeting with their conference organizing committee. As chair of the NOISE-CON conference, Jim Thompson was asked to participate in this meeting. The SAE committee felt the co-located conference was an outstanding success and asked that INCE-USA plan to hold another such conference in the future. It was tentatively agreed to conduct another such co-located conference in 2023, the first date available in the INCE-USA schedule. 

What to Know about the WELL Building Standard—Sound

Ethan Bourdeau

The WELL Building Standard™ (WELL) sets performance requirements in seven Concepts relevant to occupant health in the built environment—air, water, nourishment, light, fitness, comfort, and mind. WELL Certified™ spaces can help create a built environment that improves the nutrition, fitness, mood, sleep patterns, and performance of its occupants. Within the concept of comfort specifically are features that pertain to acoustical comfort and how acoustical design elements can aid occupant well-being and productivity.

Built environments can harbor sounds that are distracting and disruptive to work or relaxation. Employee surveys show that acoustic problems are a leading source of dissatisfaction within the environmental conditions of an office. As acoustic comfort is determined in part by the physical properties and contents of environments, the WELL Building Standard aims to shape spaces to mitigate unwanted indoor noise levels and reduce exterior noise intrusion in order to enhance social interaction, learning, satisfaction, and productivity. While noise is ubiquitous, the WELL Building Standard is able to adopt policies, technologies, and practices that ensure quieter acoustical environments and minimize our exposure to harmful and unnecessary sound.

Projects that aim for WELL Certification are required to achieve all preconditions to achieve Silver Certification. For acoustics, these features include meeting Exterior Noise Intrusion and Internally Generated

Noise requirements. Projects can also pursue design optimizations to achieve Gold and Platinum Certification. For acoustics, these include Reverberation Time, Sound Masking, Sound Reducing Surfaces, and Sound Barriers.

There are features throughout the standard that also require Performance Verification in order to pass (e.g., air/water quality testing, HVAC commissioning, etc.) Performance Verification is carried out by a WELL Assessor who, in the case of acoustics, is trained to use a sound level meter to measure Exterior Noise Intrusion, Internally Generated Noise, Reverberation Time, and Sound Masking. The performance requirements for these features are listed below:

Exterior Noise Intrusion—The average sound pressure level from outside noise intrusion does not exceed 50 dBA when measured 1m (39 inches) away from window wall in a regularly occupied space during a period where adjacent spaces are unoccupied but within 1 hour of normal business hours. For Multi-Family Residential projects must follow the same requirements in LEED v4 for Acoustic Comfort which requires that the max background noise level due to exterior noise sources cannot exceed 40 dBA based on peak hour Leq tested in acoustically sensitive rooms.

Internally Generated Noise—In offices, the maximum background noise levels are based on recommendations

from GSA's Sound Matters and are as follows: Open offices and lobbies that are regularly occupied and/or contain workstations—NC 40; Enclosed offices—NC 35; Conference rooms and breakout rooms—NC 35 (25 recommended). For Multi-Family Residential projects, the internally generated noise levels are from the LEED v4 credit for Acoustic Comfort and are limited to a max of 40 dBA based on peak hourly Leq.

Reverberation Time—For offices, maximum allowable reverberation times (RT_{60}) are based on GSA's Sound Matters which recommends 0.6 seconds for conference rooms and 0.5 seconds for open offices.

Sound Masking—In offices, sound masking system output level at workspaces is limited to 45–48 dBA at open workspaces and 40–42 dBA in enclosed offices. These ranges are based on recommendations provided in the GSA's Sound Matters.

(A more comprehensive list of the performance verification testing methods and procedures can be found in the Performance Verification Guide Book at wellcertified.com.)

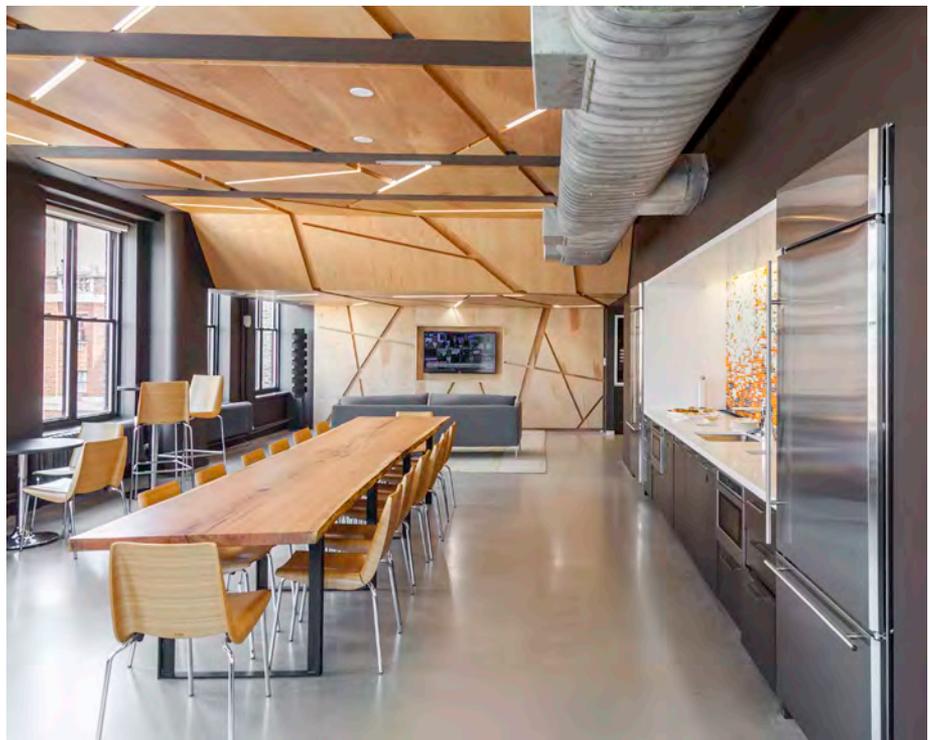
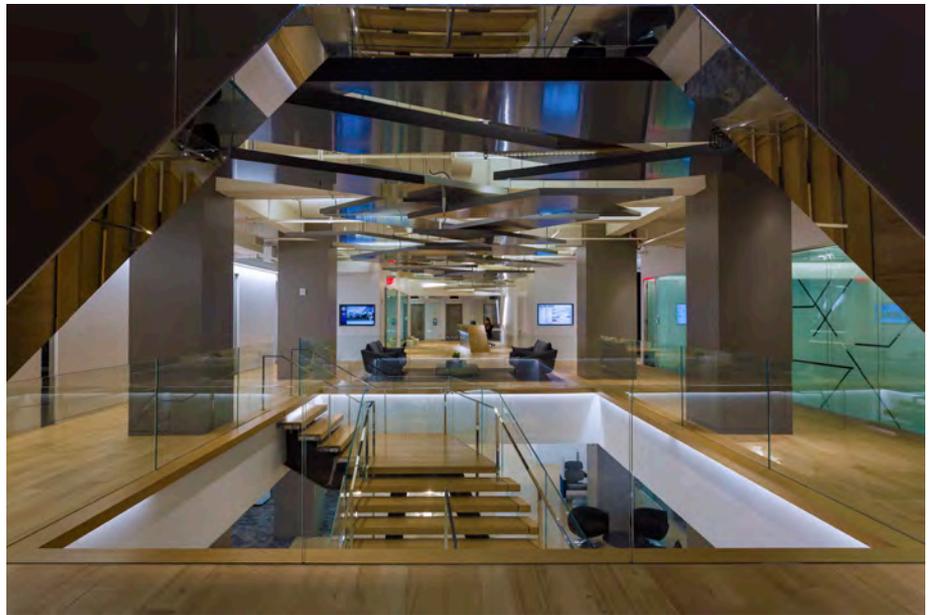
In addition to features that require Performance Verification, other feature parts require supplemental documentation to pass. For example, acoustical planning where needed is submitted via an acoustical narrative (e.g., noisy/quiet

zones, site planning, etc.). Similarly, where product performance data is required in design, a letter of assurance from the architect, complete with product submittal data where applicable, should be submitted in order to pass (i.e., NRC, STC, etc.).

During the certification process, project teams may feel limited to achieving design parameters that are not typically used in their region, such as noise criteria (NC) or noise insulation class (NIC). If this is the case, the project team can submit a request for Equivalency, which outlines a project team's intent to use an equivalent metric, testing procedure, or guideline that aims to achieve the same requirements outlined in the existing standard.

The future of acoustics in the WELL Building Standard is contingent upon the ever-expanding depth of research highlighting the effect of sound on humans in the built environment. With the coming release of WELL v2, set for early 2018, the Acoustics concept will undergo the changes necessary to best highlight the existing research pointing to the health effects of noise exposure and will also be designed with feasibility in mind for project teams seeking certification.

You can find members of the International WELL Building Institute™ (IWBI™) at such upcoming events as the Center for the Built Environment at their annual conference in October, at Green Build in Boston this November, at the Acoustical Society of America meeting in New Orleans this December, and online at <https://www.wellcertified.com/>. 



WELL in action in New York—Structuretone's new NYC offices

The Next Step in *Noise/News International*

Noise/News International (NNI) is a free quarterly digital publication of the International Institute of Noise Control Engineers and the Institute of Noise Control Engineering of the USA. For close to 25 years, NNI has served as a leading source of news for noise and vibration control professionals across the world. It is read by noise control and vibration control engineers in 44 countries, with bonus distributions at major national and international noise and vibration control meetings.

Since summer 2016, NNI has been going through a transition. The magazine has moved from the traditional PDF version of a paper magazine to a digital blog format. It is now a fully digital publication with all articles hosted on noiseneewsinternational.net, as well as appearing in a quarterly PDF publication. These changes enable the publication to provide up-to-date information immediately and facilitate a dialogue related to noise control. With today's fast-paced world, NNI is taking the next step in getting information to readers as quickly as possible, and is now beginning to build a social media presence.

It is our hope that this new format and means of delivering NNI is an improvement for you, the reader. Undoubtedly, there are areas where we can improve. Please provide feedback on the website, blog, and via social media—What do you like? What would you like to see included? Did you have trouble finding something? We hope the publication becomes a resource for you to both use and contribute to. By building the presence of both our publication and community online, our aim is that NNI will become the first stop for anyone interested in news and information about noise control across the globe.

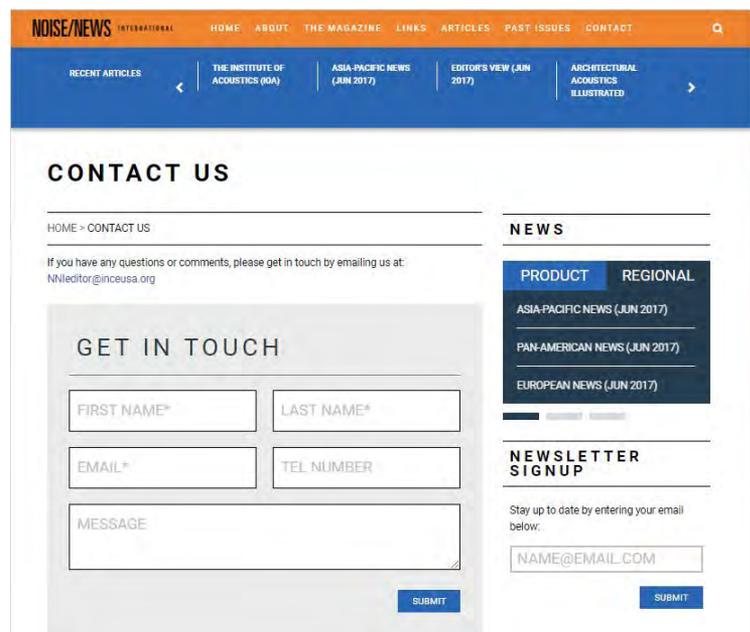
So, please feel free to [subscribe to our newsletter](#), like us on [Facebook](#), follow us

on [Twitter](#) (@NNIEditor), and stay up to date for all *Noise/News International*.

Have Something to Say?

NNI is the preferred channel to reach engineers and other professionals whose practices concern the prediction, avoidance, abatement, measurement,

analysis, classification, and control of noise and vibration. We always welcome contributions for publication and would be happy to receive material related to noise and vibration control, including: case studies, technical reviews, recent research reports, product news, event updates, and member society news. 



Current I-INCE Pan American Member Societies

Society
Asociacion de Acusticos Argentina (observer only)
Acoustical Society of America
Acoustical Society of Chile
American Society of Mechanical Engineering, NCAD
Brazilian Acoustical Society (SOBRAC)
Brazilian Association for Acoustical Quality (ProAcústica)
Canadian Acoustical Association
INCE-USA

News and Events

News and events for each member society are listed below. The following member societies have been unresponsive to requests for news for the past several years: Acoustical Society of Chile, Asociacion de Acusticos Argentina, and SOBRAC.

Asociacion de Acusticos Argentinos (observer)

No news provided, but the ICA 2016 conference was held in Buenos Aires, Argentina, September 5–9, 2016.

Acoustical Society of America (ASA)

The purpose of ASA (acousticalsociety.org) is to generate, disseminate, and promote the knowledge and practical applications of acoustics. The ASA publishes the *Journal of the Acoustical Society of America*, and holds biyearly meetings.

ASA Meetings

The Acoustical Society of America held two meetings in 2016:

- The spring 2016 meeting was held in Salt Lake City, UT, in May and drew over 1,000 attendees.
- The fall 2016 meeting was held in Honolulu, HI, in November. The meeting was held jointly with the Acoustical Society of Japan and drew over 2,200 attendees.

ASA Awards

Several awards were presented at the spring and fall meetings, including:

- the Gold Medal to Whitlow W.L. Au
- the Helmholtz-Rayleigh Interdisciplinary Silver Medal to Armen Sarvazyan
- the Trent-Crede Medal to Earl G. Williams
- the R. Bruce Lindsay Award to Megan S. Ballard
- the Distinguished Service Citation to Susan B. Blaeser

The newly-established Leo and Gabriella Beranek Scholarship in Architectural Acoustics and Noise Control was awarded in 2016 to Andrew Hulva.

ASA Leadership

Changes have occurred to several ASA leadership positions. Marcia J. Isakson of the University of Texas at Austin is the new president, and Michael J. Buckingham is the new vice president. At the 2015 ASA election, Michael R. Stinson of the National Research Council of Canada was elected president-elect.

ASME Noise Control and Acoustics Division

The ASME Noise Control and Acoustics Division (NCAD) (https://community.asme.org/noise_control_acoustics_division/)

[default.aspx](#)) objectives are to establish a program within ASME that will encourage, focus, and further the development and application of noise control and acoustics principles to all engineering branches.

ASME NCAD Meetings

In November 2016, NCAD sponsored a technical track on Vibration, Acoustics, and Wave Propagation at the annual American Society of Mechanical Engineers (ASME) International Mechanical Engineering Congress and Exposition (IMECE), which was held in Phoenix, AZ. At IMECE2016, NCAD sponsored a total of 18 technical sessions, with approximately 90 technical talks on a variety of topics in noise control and acoustics. At the conference, NCAD organized the NCAD tutorial workshop as one of the track plenary sessions. Dr. Miao Yu from the University of Maryland was the workshop speaker and gave a talk on “Acoustic Sensing Technology.” Another plenary talk was given by Dr. Bahram Djafari-Rouhani of the University of Lille entitled “Presentation: Phonon Tunneling Through Vacuum Cavity in Finite Piezoelectric Superlattice.”

For IMECE2017, NCAD is proud to a sponsor a technical track on Acoustics, Vibration, and Phononics. There are expected to be approximately 90 technical talks on a variety of topics in noise control and acoustics. Dr. Chris Fuller from Virginia Tech University will give the Rayleigh Lecture and Dr. Massimo Ruzzene from the Georgia Institute of Technology will give both the NCAD tutorial workshop and the Phononics Plenary talk. IMECE2017 will be held November 3–9 in Tampa, FL.

ASME NCAD Awards

The 2016 Per Bruel Gold Medal was awarded to Patricia Davies, Ph.D., 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.

During IMECE2016, NCAD recognized and awarded three student papers through the NCAD student paper contest. The student papers were judged based on the quality of both the written paper and the oral presentation at the conference. Mr. Plinio Ferreira from Memorial University in St. Johns, Canada; Mr. Dante Tufano from Rensselaer Institute in Troy, NY; and Mr. Junjian Zhang from the University of Kansas in Lawrence, KS, won the 1st, 2nd, and 3rd places respectively.

ASME NCAD Leadership

The current chair of the Group Leadership Team is Shung (Sue) Sung (GM retired) and the vice-chair is Charlie Zheng of Kansas University. Ab Kirwan (General Dynamics Electric Boat) is Treasurer, and Weidong Zhu is Secretary.

ASME NCAD Other News

Peer-reviewed publications are sponsored through conference proceedings and the *ASME Journal of Vibration and Acoustics* for which NCAD provides associate editors.

For more information, please see our annual newsletter and website at https://community.asme.org/noise_control_acoustics_division/m/default.aspx and friend us on Facebook at [NCAD](#).

Brazil—ProAcústica

The Brazilian Association for Acoustical Quality (ProAcústica) (www.proacustica.org.br)—a Member Society of I-INCE since 2013—is a nonprofit civil entity with the purpose of congregating companies and professionals looking to develop applied

acoustics in Brazil, a field that also covers the science of vibrations. The ProAcústica Association was born from the initiative of companies and professionals that identified the opportunity to disclose to all of society the importance of acoustic quality in buildings and the environment, as a factor of well-being and public health.

Currently 70 companies are members:

- 38 manufacturers of acoustic products (54%)
- 21 acoustic project and consulting firms (30%)
- 7 installation and distribution companies (10%)
- 4 laboratories (6%)

ProAcústica Leadership

- Edison Claro de Moraes (AtenuaSom), Executive Chairman
- Alberto Safra (Aubicon), Vice President Administrative Financial
- Davi Akkerman (Harmonia Acústica), Vice President of Technical Activities
- Luciano Nakad Marcolino (Owa Brasil), Vice President of Communications and Marketing
- Fernando Neves Caffaro (Isover Brasil), Vice President of Investor Relations
- Cláudio Benevides Soares (Knauf Brasil), Vice President of Associative Resources

There are also technical committees on Environmental Acoustics (coordinated by Marcos Holtz), and Acoustics in Buildings (coordinated by Juan Frias Pierrard). An ethics committee has been formed recently to prepare a compliance manual for ProAcústica members.

Other News

The International Day of Noise Awareness was observed on April 26, 2017, by “The Manifest of the Silence” at the

Bandeiras Monument, Ibirapuera São Paulo. Actions were in partnership with the Municipal Secretariat of Green and Environment of São Paulo (SVMA).

A documentary on “Acoustics for Schools” presents the results of solidarity action with acoustics intervention in a Municipal School of São Paulo. The initiative is the result of a joint action promoted by the Association and presents the results in the quality of the school environment after installation of acoustic solutions.

Canadian Acoustical Association

The Canadian Acoustical Associate (CAA) (<http://caa-aca.ca/>) is the professional, interdisciplinary organization that:

- fosters communication among people working in all areas of acoustics in Canada,
- promotes the growth and practical application of knowledge in acoustics,
- encourages education, research, protection of the environment, and employment in acoustics, and
- is an umbrella organization through which general issues in education, employment, and research can be addressed at a national and multidisciplinary level.

CAA Meetings

In September 2016, the Association held its annual conference and technical exhibition at the Sutton Place Hotel in Vancouver, British Columbia. The organizing committee was led by chair Kathy Pichora-Fuller. The event attracted around 170 delegates and achieved good sponsorship support and exhibitors’ participation, realizing a profit for the Association. The AGM of the Association members was also held during the conference, as was the Autumn meeting of the BoD. The

2017 annual conference will take place in October in Guelph, Ontario.

CAA Leadership

A significant change in the Association's roster of appointed officers took place during the past year with the transition of Editor in Chief of the journal *Canadian Acoustics* from Jérémie Voix to Umberto Berardi. During his tenure, Jérémie oversaw a major transition of the journal from paper-only publishing to the digital domain with the creation of a 40-year archive accessible online and ongoing digital open access to all issues of the publication older than 12 months.

The current president of the CAA is Frank Russo (Ryerson University), the past president is Christian Giguere (Universite d'Ottawa), and the executive secretary is Robert Racca (JASCO Applied Sciences).

INCE-USA

INCE-USA (www.inceusa.org) is a nonprofit professional organization incorporated in Washington, DC. The primary purpose of the Institute is to promote, through its members, noise control solutions to environmental, product, machinery, industrial, and other noise problems.

INCE-USA Meetings

The NOISE-CON conference was held in Grand Rapids, MI, which was a joint meeting with the Noise Vibration and Harshness (NVH) community of the Society of Automotive Engineering

(SAE). There was some trepidation in planning a joint meeting but in the end it turned out to be very successful, and both INCE-USA and SAE are looking forward to having another joint meeting in the not-too-distant future. Thanks to Jim Thompson and his team who really did a fantastic job.

INCE-USA Leadership

INCE-USA saw another year of change in 2017. The president for the second year running is Richard (Rick) A. Kolano of Kolano and Saha Engineers, Inc. As president-elect, Steve Marshall has been approved by the annual general meeting, which was held in January 2017 in Detroit, MI. Other leadership changes include Jim Thompson as VP of Board Affairs and Sanghoon (Sam) Suh taking over as VP of Publications.

INCE-USA Awards

Thanks to the INCE Foundation, led by Eric Wood, several awards are given to outstanding noise control engineers. This year, James Barnes received the Laymon Miller Award for Excellence in Acoustical Consulting. Several Beranek Student Medal awards were also given at the NOISE-CON conference. To learn more about the INCE Foundation or to make a donation, see www.inceusa.org/about/foundation.

INCE-USA Other News

After many years being the Editor of NCEJ, Courtney Burroughs decided this year to let someone else do this job. INCE-USA wishes to thank Courtney

for the awesome job he did for many years as NCEJ Editor. Continuing with publications, Jim Thompson has taken over as Editor of NCEJ as of July 1 and Eoin King is now the Managing Editor of NNI. Eoin has some new interesting ideas for NNI, especially after last year's transition from a PDF publication to an online blog. Eoin wants to introduce a greater element of social media, so watch for changes in how you interact with NNI!

Another notable event this year is the online offering of the Noise Control Engineering Course, which, if successfully completed, will serve in lieu of the professional exam for becoming board certified. This course has generated a lot of interest, and Courtney Burroughs will be the instructor. Further information on the courses and the material covered and cost can be obtained from the INCE-USA website (<https://www.inceusa.org/careers-education/courses-and-training/>). Look for more changes to the Board Certification in the coming years. 📄



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◆ Transportation noise	◆ E966, HUD, FAA
◆ Seismic vibration surveys	◆ Scientific, residential

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Asia-Pacific News

Australia

AAAC becomes Australasian

The peak body committed to supporting the acoustics profession, the Association of Australasian Acoustical Consultants (AAAC), announces that it will now represent acoustical consultancies in New Zealand as well as Australia.

The organization now has 65 member firms employing approximately 400 consultants reflecting a \$90m-sized industry. Its members are comprised of the most highly qualified and experienced acoustic professionals across Australasia. AAAC members provide advice to a diverse range of clients from developers and property owners to planners and architects, lawyers, local authorities and private householders, and lead their profession in technical expertise, research, innovation, and development of real-world, practical solutions for application to all types of environments.

The AAAC aims to raise the standards of acoustics practice across Australasia. The peak body helps to educate industry professionals and the public on the role that good acoustics and the management and mitigation of noise and vibration play in achieving good design and effective planning in the built and natural environment.

Acoustics 2017 Perth

The annual Australian Acoustical Society conference in 2017 is November 19–22. The theme is Sound, Science, and Society.

The conference will be held in the City of Perth at the five-star Pan Pacific Hotel, within easy walking distance to the new

Elizabeth Quay and rejuvenated city center with renowned restaurants and bars.

The full program of specialist workshops and social events will complement leading technical presentations. The distinguished speakers and invited experts include Chris Allen, NASA (Acoustics issues with Spaceflight Vehicles / International Space Station), and Dr. David Bradley, Penn State University (Underwater Acoustic Propagation Modelling). The event also represents an outstanding opportunity for those in the industry to network and engage, with a detailed sponsorship prospectus now available.

More information: www.acoustics2017.com

(News sources) Marion Burgess and Truda King

Japan

2017 Autumn Meeting of the INCE/J

The INCE/J will hold the 2017 autumn research meeting on November 16–17, 2017, at Senju Campus, Tokyo Denki University in Tokyo, Japan. The meeting will have two organized sessions, as reported in the NNI June issue, and about seventy paper submissions. There will also be a special symposium on “Environmental Education and Sound,” in which four invited lectures will be presented concerning education on acoustical environment aimed at nursery, primary, high school, and university students.

2017 Autumn Meeting of the ASJ

The ASJ will hold the 2017 autumn research meeting on September 25–27,

2017, at Ehime University in Ehime Prefecture Japan, as reported in the NNI June issue. The meeting will have ten special sessions and about 600 paper presentations and posters. The meeting is also planned to hold a special joint session between the ASJ and the ASK (the Acoustical Society of Korea). The joint session will be held on the second day, September 26, as a one-room/one-day session consisting of fifteen lectures (ten invited papers from ASK and five contributed from ASJ) from the research fields of architectural acoustics, etc. For more information, please visit: http://www.asj.gr.jp/annualmeeting/pdf/2017autumn_program.pdf or [http://www.asj.gr.jp/annualmeeting/ASJ2017autumnCFP\(E\).html](http://www.asj.gr.jp/annualmeeting/ASJ2017autumnCFP(E).html).

2018 Spring Meeting of the ASJ

The ASJ will hold the 2018 spring research meeting on March 13–15, 2018, at Nippon Institute of Technology in Miyashiro campus, Saitama Prefecture, Japan.

Recent Social-Contribution Activities of the INCE/J

The INCE/J took part in a special event of “Children’s Visit-Kasumigaseki Day,” which was an annual experiential tour of twenty-five ministries and agencies of the national government for elementary and junior high school students, held on August 2–3, 2017. The INCE/J provided an exhibition booth where visitors enjoyed producing and playing with a handmade sound-producing toy, “Voice-copter,” at the venue in the Ministry of the Environment. There were about 500 visitors and a total of 350 voice-copters were produced during the event.

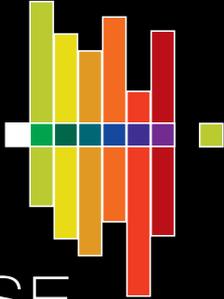
Feature Articles in Recent Three Editions of INCE/J Journal

The INCE/J Journal Vol. 41, No. 2, published in April, focused on “aerodynamic sound and fluid sound” with a general account of “Generation of fluid sound and numerical analysis” and 6 technical data reports dealing with reduction of aerodynamic sound from railway car and pantograph, aircraft fuselage and small fan, fluid noise in plant piping, and aerodynamic sound in buildings. The INCE/J Journal Vol. 41, No. 3, published in June, featured

“Acoustical technology to prepare for natural disasters” with 4 review accounts: (1) monitoring of natural disaster by infra sound measurement, (2) trend of the disaster prevention broadcasting, (3) proposal of an ASJ standard on outdoor voice transmission of disaster information, and (4) recent trends on disaster information transmission triggered by frequent, heavily torrential downpours. The INCE/J Journal Vol. 41, No. 4, published this August, featured “Environmental measures for aircraft noise” with a general account of “Environmental Quality Standards on

Aircraft noise and current status of its enforcement” and 5 review accounts: (1) efforts to reduce aircraft noise around the airport, (2) noise abatement approach near the airport relevant to aircraft operation and air traffic control, (3) efforts for reducing impact of aircraft noise on local communities at Fukuoka City, (4) efforts for reducing impact of aircraft noise on local communities at Narita city, and (5) review of aircraft noise prediction and its current status.

(News sources) WEB Pages and Secretary Office of the INCE/J and the ASJ 



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Book Reviews

Structural Health Monitoring of Composite Structures

Ginu Rajan and B. Gangadhara Prusty,

Editors

CRC Press, Taylor & Francis Group, Boca Raton, (2016)

491 pp., 175.96 USD

ISBN-13: 978-1-4987-3317-5

With 12 Chapters, 479 pages (plus a 10-page index), and 27 international contributors, this is a serious book with some serious value and it is worth briefly reviewing every chapter.

1. *Introduction to Composite Materials and Smart Structures* is exactly what one would expect it to be: a very clear presentation of fundamentals with tables, photographs, and simple explanations of manufacturing processes, followed by a brief overview of applications and a fine bibliography.
2. *Structural Health Monitoring Methods for Composite Materials* is a nice review of various approaches to the topic (elastic waves, acoustic emission, EM impedance, vibration, etc.) that uses clear graphs and photographs. A very extensive reference section completes a clear chapter.
3. *Introduction to Optical Fiber Sensors* offers a fine review of modulation methods including schematics, equations, and practical applications. The classification of the sensors is very clear and the reference section is good, albeit a little bit dated (the most current reference is from 2012).
4. *Structural Health Monitoring of Composite Materials Using Fiber Bragg Gratings* ought to be considered a book by itself. The specialized FBG topics and methods are covered in exquisite depth and detail, from fundamental

equations to practical implementation methods and techniques. It has 153 references!

5. *Structural Health Monitoring of Composite Materials Using Distributed Fiber-Optic Sensors* starts with an excellent introduction and overview, followed by some detailed and focused examples. The chapter offers a lot of visual information including many detailed graphics in color. The organization and the references are excellent.
6. *Importance of Strain Transfer Effects for Embedded Multiaxial Strain Sensing and Optical Fiber Coating Optimization* is a long title written by the same authors as Chapter 4 and it shows. It is very detailed, very complete, supported by clear graphs (many in colors), illustrations, well-presented equations, and a fine bibliography.
7. *Monitoring Process Parameters Using Optical Fiber Sensors in Composite Production* is focused on practical applications. There is some repetition of previous fundamental material but some of it is welcome in terms of ease-of-reading. The chapter is an appropriate blend of theory and applications.
8. *FBG-Based Structural Performance Monitoring and Safety Evaluation of a Composite Arch Bridge* is a much focused example of a practical application. There is some repeat of FBG fundamental material that could be edited-out without hurting clarity in the context of this book. The illustrations are clear and some of the conclusions are very interesting.
9. *Smart Composite Textiles with Embedded Optical Fibers* is another focused chapter presenting a relatively new application in a clear and effective fashion. Theory is kept to a minimum and the reading is very

easy, supported by excellent graphics and photographs. The references are very current.

10. *Smart Aerospace Composite Structures* is another application-focused chapter. As before, it is very clear in terms of combining text and graphs, although I had to wonder why a figure (10.19) showed six (6) different data sets (in colors) without a legend. The authors' argument was to demonstrate that some situations are just too complex to yield predictable models.
11. *Advances in FRB-Based Smart Components and Structures* is a good chapter, offering very clear explanations supported with graphs, photographs and selected equations. The references are somewhat current (2014) considering the title of the chapter.
12. *Fiber-Optic Structural Health Monitoring Systems for Marine Composite Structures* may be the most specialized chapter in the book (it is co-authored by one of the editors) and it is heavy on details. Still, it makes for interesting reading, thanks to a good balance of text, tables, graphs and images.

If I had to describe this book in a single sentence, it would be "A well-edited and well-titled text that offers the reader a solid and detailed reference perspective of the topics using the appropriate tools at the appropriate locations." Now, I am wondering why I did not choose the single-sentence option.

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Physics of the Piano

Nicholas J. Giordano, Sr.
Oxford University Press, (2016)
170 pp., paperback, 25.20 USD
ISBN: 978-0-19-878914

Why would it take two people to review a book with a total page count of 170 (including References and Index)? Simple: This is a book written by a physicist with musical abilities and a passion to share his enthusiasm for the instrument, so we thought it would be fair to have the work reviewed by both a scientist with limited musical abilities (none pertaining to the piano) and by a nonscientist with excellent musical abilities and skills in classical piano.

Both of us agreed that a nice thing about the book is the table of contents, which is very detailed and user friendly. The chapter titles are short and descriptive and they are extremely well-organized. This allows the nonprofessional to peruse the material in a nonlinear manner, picking and choosing according to one's interests. The subdivisions within the chapters are also useful in selecting according to one's curiosity and level.

The chapters too are short but well-illustrated with pictures, graphs, and diagrams to facilitate comprehension. Someone with an extensive background in acoustics may choose to gloss over the most basic material; however, this would be a mistake. The author has a keen sense for explaining with great clarity and both reviewers appreciated the clean and effective sentences. The definitions of terms and the index also aid in making the book more approachable, along with the diagrams and photos, which facilitate comprehension, especially for the layperson who wishes to become more knowledgeable.

The "nonscientist" focused more on the introductory chapters ("Introduction" and "A Brief Introduction to Waves and Sound") and on those dedicated to the history of piano ("Why Was the Piano Invented?" and "Evolution of the Piano"). The "scientist" found himself fascinated with the mechanics associated with a piano ("Hitting Strings with a Hammer" and "Connecting the Strings to the Soundboard"), and both of us read Chapter 11 ("The Magic of Steinway") with great interest.

The author's passion for the piano is evident on every page; it is abundantly clear that writing this book was a labor of love and the reader will not be disappointed.

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Spatial Audio Reproduction with Primary Ambient Extraction

JianJun He
Springer, New York, (2017)
132 pp., softcover, 54.99 USD
ISBN: 978-981-10-1550-2

This publication appears to be a popularized dissertation of JianJun He's PhD work at Nanyang Technological University in Singapore. Primary ambient extraction (PAE) is the name given to any set of digital signal processing (DSP) techniques, performed during the playback of an audio file, and having the goal of optimizing the accuracy and immersiveness of the perceived spatial audio reproduction relative to the intended soundscape. The PAE separates the primary sources (those having coherent directivity) from the ambient sounds in the audio recording in preparation for subsequent DSP and signal routing to loudspeakers or headphones, with paths tailored for each type of signal. Typically, PAE is not required for audio files having formats matched to the playback system, such as stereo files played over stereo speakers or surround-encoded files played over a matching set of surround speakers. In these cases, one expects the mix to be optimized for the designated playback arrangement. However, PAE will be

required when attempting to translate audio recorded in one format for optimal spatial reproduction in a mismatched playback arrangement, such as stereo files played over a surround speaker arrangement or surround-encoded files played over a 3D speaker arrangement.

The book is premised on the assumption that the performance of existing PAEs on existing recordings (having a variety of mixing and recording formats) may be quantitatively measured. With this measurement tool in hand, improved extraction techniques can then be quantitatively judged.

Throughout the book, various methods are reviewed for extracting primary and ambient signals from single-, two-, and multi-channel recordings. Performance measures are chosen, improved processes are suggested and developed, and the old and new methods are graded on their abilities to extract primary and ambient signals from several benchmark recordings. Each of these benchmark recordings is manufactured for the purpose at hand, so everything is known about their primary and ambient sources, microphones, mixes and recording formats a priori.

Although the author contends that all existing audio recordings can be described and judged by a finite set of recording and mixing processes, what is missing is some sort of statistical sampling of how well those real recordings fit the finite assumptions used to create the benchmarks with which the book gauges process performance. JianJun He touches on this issue in the very last paragraph of the book, noting that "PAE is a blind process . . . performance relies heavily on how effective the signal model is . . . not one signal model could satisfy any audio content," and proposes machine learning as a possible solution.

With that proviso out of the way, I found the book to be an excellent primer and reference on the title subject. Each chapter

ends with a generous bibliography of additional references for specific PAE subjects. The author's selection of PAE type groupings and methods of grading performance are clear and logical. The development of improved PAE is straightforward and the benchmarking experiments are defensible. Reading may be complicated by an excessive use of two- and three-letter abbreviations throughout the text, with a couple abbreviations missing their initial definitions; however, those working within the discipline should have few problems.

The final chapter reviews the current state of PAE, the book's contributions in improving those processes, and recommendations for further development. I recommend *Spatial Audio Reproduction with Primary Ambient Extraction* as a good reference for every engineer working behind the scenes to improve the user audio experience.

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Room Acoustics—Sixth Edition

Heinrich Kuttruff
CRC Press, Boca Raton, (2016)
302 pp., hardback, 135.00 USD
ISBN: 978-1-4822-6043-4

I became acquainted with this book during my undergraduate studies, when in 1980, the late Richard Waterhouse suggested it as a supplemental text for an independent reading class in room acoustics I took with him. I welcomed the book's more mathematical grounding than other texts assigned for the class. That second edition became a resource for other classes and found frequent use when I entered industry. Since that time, the book has been updated about every seven years to reflect current thinking and new topics. The present edition adds reflections from spherical waves, sound field calculations using finite

element analysis, and acoustic auralization and virtualization to an already broad coverage of room acoustics.

The book is built on first principles and topics are presented in a concise manner devoid of extensive equation derivations. Concepts introduced earlier in the book are expanded upon, or referred to when a new topic is introduced, creating a unified presentation. The first six chapters are more theoretical and the last four chapters contain practical guidance with references back to the theory. Each of the 10 chapters concludes with an extensive reference list; however, many references are in the German language.

The author is Emeritus Professor and former director of the Institute of Technical Acoustics at Aachen University, Germany.

Chapter 1 introduces the reader to basic acoustic concepts to include the wave equation, plane and spherical waves, concepts of energy density and intensity, basic signal system analysis, sound pressure and sound power, hearing basics, and elementary sound sources. There is sufficient coverage of the fundamentals for a quick acoustics introduction and many of the topics are expanded upon in later chapters.

Reflection and scattering of sound from surfaces is the subject of Chapter 2.

The author discusses sound reflections separately for plane, spherical and random incidence wave fronts. Other topics include surface reflection, absorption and impedance aspects of boundaries, reflections from finite sized objects, and number theory diffusing surfaces. A concise definition of a locally reacting surface is welcomed as are examples of sound absorption mechanisms and surface impedance concepts.

Chapter 3 provides the first instance of earlier material presented in greater depth. Here, the wave equation is expanded beyond the simple concepts introduced

in Chapter 1 to include finite element methods of solution. Other topics cover normal modes in rectangular rooms, eigenfrequency density, nonrigid walls, steady state sound fields, decaying modes, and the first introduction of reverberation. A topic I have not found in other texts is an introduction to elementary room transfer functions for frequencies above the Schroeder frequency.

Geometrical room acoustics principles are covered in Chapter 4. The basics of specular reflections evolve into the basics of image sources including those that are visible and contribute to the room impulse response. The number of reflections received within a time interval is introduced, and this, along with the energy density, is used to derive the reverberation time for an exponentially decaying sound field. Sound reflections from concave surfaces are addressed where this geometry can result in sound focusing or diffusion based on the positions of sound source and receiver. The chapter concludes with two theoretical treatments: the radiosity integral and the diffusion equation. The former is introduced by way of diffuse surface scattering according to Lambert's law and progressing to the concept of irradiance. Different ideas for the diffusion equation based on energy flux models proposed by several researchers are described with a conclusion that sound particles undergo a Brownian motion due to irregular room geometry.

Chapter 5 summarizes concepts of reverberation and steady-state energy density in more detail than in earlier chapters. The chapter starts with a description of diffuse sound fields and sound decay to include factors that influence sound field diffusiveness. The traditional mean free path length is described, as is the author's contribution of the relative variance of the mean free path length distribution. Unequal path lengths are treated in terms of probability

distribution of surface sound reflections to calculate the resultant sound energy. From the energy and relative variance, a modified Sabine reverberation time equation is derived with an absorption exponent accounting for the relative variance of the path length distributions. This equation, as pointed out by the author, is only applicable to simple room geometries. A sound source driving an enclosed volume is covered next and considers the reverberant and direct sound energy density components and the critical distance where these values are equal. Lastly, the chapter applies the radiosity integral concept to consider the more realistic condition of nonideal diffuse field room conditions where the surface boundary reflects sound according to Lambert's cosine law. Examples of nonuniform boundary absorption are presented in terms of the difference between Sabine and Eyring reverberation times for different room shapes and volumes.

Sound absorption mechanisms are reviewed in Chapter 6. Absorption by air is described first followed by membranes and perforated sheets. Resonance phenomena are explained separately for panel absorbers and Helmholtz resonators. Sound propagation through porous materials uses the Rayleigh model to describe this process followed by practical examples of porous absorbers based on impedance considerations. The chapter concludes with the effects of audience and seat absorption and requirements for designing anechoic rooms.

Chapter 7 addresses subjective aspects of room acoustics and how these principles can be applied to design better sounding rooms. The first major topic described is the perception of sound reflections and echoes, both in terms of audibility threshold and timbral effects. Some of the more common early energy ratios for quantifying subjective room acoustics are outlined followed by evaluations of reverberation and spaciousness. The chapter concludes

with an overview of methods developed by researchers to subjectively assess concert hall sound quality.

Chapter 8 covers in-situ and laboratory room acoustic measurements. An introduction to instrumentation is followed by descriptions of measuring and evaluating the room impulse response using maximum length sequences and swept sine wave signals. Energy ratios and reverberation measurement techniques then follow. Spatial sound fields are covered with an emphasis on the measurement techniques and evaluation developed by Japanese researchers in the late 1980s and early 1990s. Laboratory acoustic measurements for determining sound absorption via impedance tube and reverberation chamber techniques are presented. The chapter concludes with a brief description of measurement methods to evaluate material surface scattering coefficients based on the research of D'Antonio, Vorländer, and Mommertz.

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Room acoustic design concepts for large assembly spaces are reviewed in Chapter 9 outlined as a practical tutorial. Topics include noise level prediction (more applicable for large nonassembly spaces such as offices and workshops), seating layout for maximizing direct sound on the audience, room shaping to avoid sound focusing and to promote useful early sound reflections and reverberation time including simplified calculations, damping constants, and coupled rooms. A brief synopsis of precedent concert halls and large multipurpose halls illustrates various acoustic and architectural features that contribute to their success. Current room acoustic design techniques, such as computer modeling and virtual reality auralization, are explained in the context of the earlier widespread use of physical scale models.

The book concludes with Chapter 10 addressing electroacoustic systems

both for sound reinforcement and acoustic enhancement functions. This is a useful topic in a room acoustics book because most large assembly spaces have electroacoustic systems and the acoustician should have a basic understanding of their design principles. The chapter starts with a basic review of loudspeakers to include cone, horn and line array types followed by acoustic power output requirements for the room. Loudspeaker position is then covered with primary emphasis on central cluster and delayed loudspeaker configurations. The mechanism of electroacoustic feedback is covered in some depth in terms of the system gain structure that causes feedback to occur. Control methods such as frequency flattening and frequency shifting are described to limit feedback potential. Acoustic enhancement systems are covered with emphasis on external reverberators, including wave front

synthesis, and controlled feedback, such as “assisted resonance” systems.

When reading through the book, I found approximately 15 editing errors, most of which include typos, inconsistent use of equation symbols, and a few incorrect references to equation or figure numbers. Clear graphics complement the text, with much material repeated from earlier editions. A welcome feature is a symbols list at the beginning of the book.

Overall, this edition provides valuable new material to keep this classic text up-to-date. If your work or studies involves room acoustics, this book should be your first port of call.

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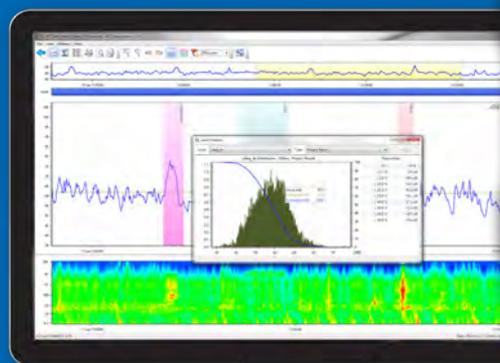
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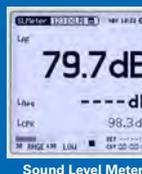
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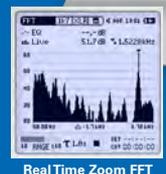
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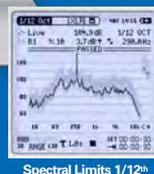
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Product News

Ecore Athletic Surfacing Debuts in Pakistan

Lahore, the capital city of the province of Punjab, is the second most populous city in the country of Pakistan. A prosperous cosmopolitan area, the people of Lahore also like to exercise; but there weren't a lot of fitness clubs.

"I was always working out and thinking about exercise," said Murad Ansari, CEO and owner of Matrix Fitness & Health. "I became obsessed with it. But there were no good gyms in my neighborhood. I had to drive 15 to 20 minutes, and other people had the same problem."

To solve these issues, Ansari decided to leave his job in the engineering field and open his own 13,000-square-foot health club, Matrix Fitness & Health, in May. Ansari did his homework before beginning this project, which included what products to use in his facility including surfacing. "Through my contacts, I tried to find the best flooring in the world," said Ansari. "I wanted it to be long-lasting, but my most basic concern was the smell."

That's because during Ansari's travels around the world, he noticed many of the rubber surfaces in the fitness clubs he worked out in had a bad odor. "The gym is a closed space and you don't want a bad smell," said Ansari. During one of Ansari's trips, he traveled to Toronto, Canada, where he worked out in a GoodLife Fitness. Impressed with the surfacing, which GoodLife uses in its 300 locations throughout Canada, he discovered it was Ecore Athletic.

As a result, Ansari selected three Ecore Athletic surfaces for his own gym. He installed 2,000 square feet of Performance Beast, a 10.5mm dual durometer system designed for heavy strength training, in the men's weight room. He selected 2,000 square feet of Everlast, an 8mm thick

performance roll for the women's weight room and cardio area. And he specified 2,000 square feet of Performance Rally, another dual durometer system, for the studio which houses group classes like CrossFit, HIIT, yoga and dance. This surface absorbs the impact force related to aggressive functional training. Because

all three of the products are made out of performance rubber, they also provide safety, ergonomic, and acoustic benefits.

Ansari's gym has been well received, and he had 325 members join in the first month. "We've had a great response," said



Product News

Ansari. "The customers really appreciate the extra cushioning in the surface, and one of the best things about this flooring is that there is no rubber smell!"

Ansari also appreciates the floors' cleanability. "It's super easy to clean and

looks good," said Ansari. "There is a lot of dirt in Pakistan. On this floor, the dirt doesn't stick on the surface. You can mop it, and it comes off easily."

So far, all the feedback has been positive. "Nobody else in Pakistan has used Ecore

Athletic surfaces before, especially in this design and color," said Ansari.

After experiencing such great success, Ansari is already planning to open a second gym later this year, and he plans to specify more **Ecore Athletic** surfacing. 



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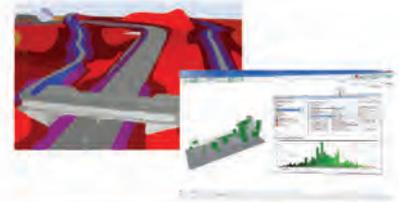
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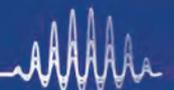
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Chicago, Illinois, USA

<https://inceusa.org/conferences/internoise-2018-chicago-il/>

■ June 16-19, 2019

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