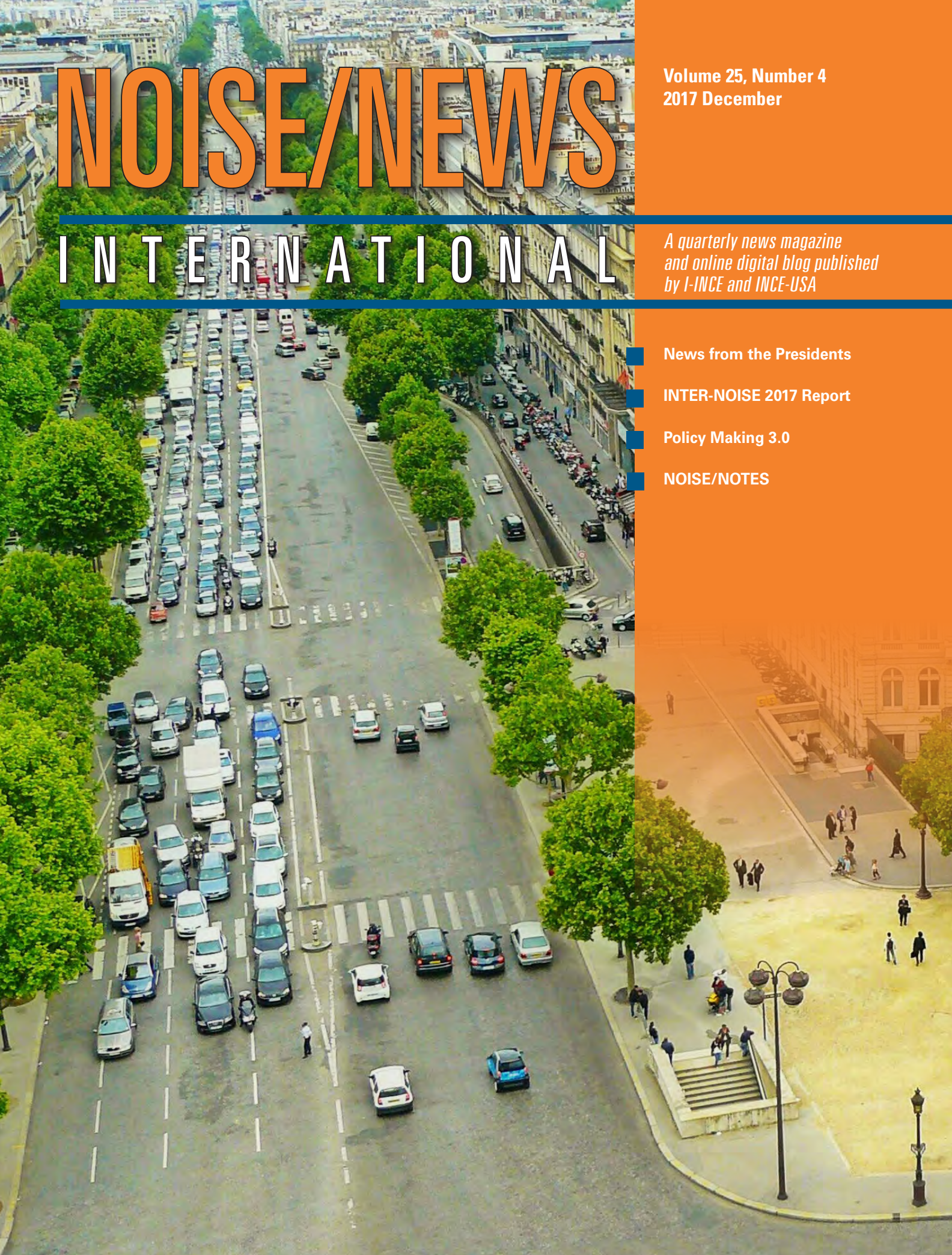
NOISE/NEWS INTERNATIONAL

Volume 25, Number 4
2017 December

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



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

Volume 25, Number 4 **2017 December**

Features

Departments

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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

From the President of I-INCE

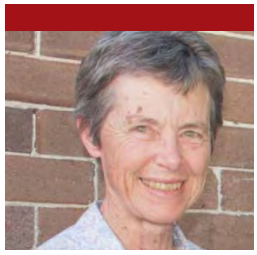
With my first editorial as president of the International Institute of Noise Control Engineering (I-INCE), I must commence with thanks to Joachim Scheuren, who achieved much during his 4-year term as president. Most importantly he took the necessary steps for I-INCE to officially exist and to open a second bank account to provide for longer term security of our funds. We are sincerely thankful to the Swiss Acoustical Society for agreeing that I-INCE can be officially located at their address. Another achievement has been the review of the Rules and of the Bylaws under which I-INCE operates, and we are grateful to Dave Holger and his committee for working through these documents and proposing revisions that are internally consistent and in keeping with our current way of operation.

Noise News International (NNI) is intended to be an important means of communication for the international noise control engineering community as a joint undertaking by I-INCE and INCE-USA. During recent years, we have formalized the Memorandum of Understanding between the two organizations. The previous managing editor, Jim Thompson, brought NNI to a web-based format with an accompanying PDF issue. We look forward to future initiatives from the new managing editor, Eoin King, as he leads future developments to utilize modern technology and to increase the relevance of NNI for all involved with noise control.

I-INCE recognizes the importance of engaging the younger community. Support for young professionals to attend an INTER-NOISE conference is an important role for I-INCE and we are very grateful to Raj Sing, VP Technical Activities, for his careful attention to this task over a number of years. He has also organized the Young Professionals Workshop during each INTER-NOISE. At Flinvoovia II, I-INCE symposium and the INTER-NOISE 2017 in Hong Kong, the first two I-INCE lectures were presented. These lectures have been recorded and will be made freely available via the web. It is intended that each INTER-NOISE will have at least one defined I-INCE lecture that will be recorded. A further initiative is the introduction of a "Practice School" for young noise control engineers. The first will be held the morning before the opening of INTER-NOISE 2018. The term for Raj has come to an end, but we are pleased that he agreed to stay on the board as distinguished board member to assist Patricia Davies as she takes over the role as VP Technical Activities.

This leads me to the major activity for I-INCE, which is the annual INTER-NOISE congress. The Hong Kong Institute of Acoustics and the Hong Kong Polytechnic University, in conjunction with the NVH branch of the Society of Automotive Engineering China and the Acoustical Society of China, were the hosts for INTER-NOISE 2017. This was a well-organized event in respect to both the technical and the social aspects of a congress. The 2018 congress return to the Pan-American region and will be hosted by INCE-USA in Chicago in August. During this congress there will be a special memorial session for Bill Lang, who passed away in late 2016. Bill was one of the founding fathers of I-INCE and we owe a great debt to him for his role in setting up and guiding this organization over the decades. The memorial session will attempt to cover some of his works and convey his passion for the control of noise for a better world for all.

Marion Burgess
President, I-INCE



Marion Burgess

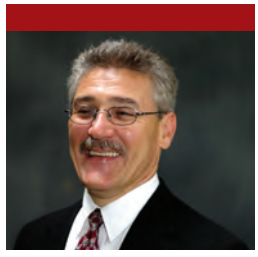
From the President of INCE-USA

The year 2017 has been another active one for INCE-USA. **NOISE-CON 2017** was held in Grand Rapids, MI as a co-conference with the **Society of Automotive Engineers 2017 Noise & Vibration Conference**. This was our first co-conference with SAE and, by all indications, a most successful one. Another co-conference with SAE is already in the planning stages for 2023.

We've also had some changes in 2017 including a changing of the guard in our publications domain. **Jim Thompson** has taken the reins from **Courtney Burroughs** as Editor of the *Noise Control Engineering Journal*. **Eoin King** has in turn relieved Jim as Editor of *Noise News International*.

We have been in the process of reviewing the INCE Bylaws primarily to keep them current relative to the laws that govern organizations like INCE-USA. This has led to two significant changes being made to Board Certification. The first will be to open INCE Board Certification (BC) to non-members of INCE-USA. A second change will be to make the entire certification process autonomous and conducted by a new, independent Certification Board. Candidates still need to meet the requirements and pass the INCE Professional Exam, but will no longer need to be approved by the INCE Board of Directors. Rather, that approval will come from the Certification Board. And recertification will also be administered by the Certification Board.

Another big change to Board Certification relates to the process of becoming Board Certified. This change allows the option to take and successfully complete three intensive, semester-long, online courses in Noise Control Engineering in lieu of taking the 8-hour Professional Exam. A candidate who otherwise meets the BC requirements can opt to take the three NCE courses and, upon successful completion, will bypass the INCE Professional Exam. These courses will also fulfill the current BC requirement that an applicant must have taken (and passed with a grade of B or better) at least two courses directly related to NCE. Actually, this change is already in place and the first round of courses is being instructed by **Courtney Burroughs**. The inaugural offering of these courses has attracted 41 candidates! This is 7 to 10 times the number of candidates that typically sit for the INCE Professional Exam each year. This alternate avenue to Board Certification plus the change that allows non–INCE-USA members to become INCE Board Certified now makes it particularly attractive to those working in NCE but living outside of the United States of America.



Richard A. Kolano

In August 2018, INCE-USA will host **INTER-NOISE 2018** in Chicago, IL. This INTER-NOISE will feature a special session dedicated to the many contributions of Bill Lang, one of INCE's founding fathers.

Come join us in the windy city. It'll be worth the trip even if only for the warm breeze off of Lake Michigan, the tremendous downtown with shopping, restaurants, museums, and Chicago's famous jazz and blues nightclubs. It's my kind of town!

For questions or more information on any of the above, contact the INCE Business Office or me at the email address below.

This will be my last column as INCE-USA President and it has been an honor to serve the NCE community for what will be two swift years come March. While I look forward to the title of INCE-USA Past President, I will miss the flurry of teleconferences, meetings, and variety of interesting challenges that are presented to the President of this fine Institute. I have been blessed to have a wide body of support from numerous INCE officers and directors, past presidents, a prolific Executive Director, and a most helpful IBO. My thanks to all of you.

Richard A. Kolano, P.E., INCE Board Certified
INCE-USA President
president@inceusa.org

Editor's View

Oh behalf of everyone here at *Noise/News International*, I would like to wish everyone the very best this holiday season. I hope you enjoy this issue of NNI. As ever we have updates from all around the world and some interesting and informative articles and book reviews. We're also introducing a new feature called NOISE/NOTES, which rounds up all the news that has been featured on our social media sites in the last few months. Please continue to follow and interact with us on Facebook and on Twitter (@NNIEditor).

As we begin to say goodbye to 2017, it is probably time to reflect on some of the highlights for the year. And for me, I had an epiphany of sorts in 2017! In November I was lucky enough to run the New York City Marathon. I've often heard it said that if you ever want to see good in the world, you should wait at the end of a marathon and watch everyone cross the finish line. While I can certainly appreciate this sentiment, another thought occurred to me while I was running (and I had a lot of time to think during the race!).

I have read that the soundscape approach to assessing the urban acoustic environment often considers the urban acoustic environment as a resource as opposed to a problem that must be controlled. In essence, we should focus on assessing the positive aspects of a soundscape rather than the negative. The idea of sound as a "resource" was never more apparent to me while running this marathon.

This was most evident as I approached Manhattan from Queens. The marathon route goes over the Queensboro Bridge. While running over this bridge (for just under a mile), it is a pretty quiet environment—all you hear is the sound of runner's feet hitting the road. But as you get closer and closer to First Avenue, you start to hear the crowd, and then boom!—you run right into a wall of sound along First Avenue that pretty much carries you all the way home. The contrast in sound levels between the bridge and First Avenue is something I will never forget. And it was certainly a resource for me and the 50,000 other runners running that race.

Next time I might wear a dosimeter!

Eoin King, Ph.D.

Eoin King, PhD

NOISE/NOTES

Eoin A. King, NNI Editor, and Eva Von Dell, NNI Social Media Assistant

NNI is on Facebook and Twitter—we try to keep our readers informed with noise news from all across the globe by highlighting interesting research and projects. Here is a roundup of some of the stories that have been making headlines. Follow @NNIEditor on Twitter to stay up to date with all noise related news.

Bose Introduces Wireless Sleep-aid "Sleepbuds"

Bose has moved into the realm of sleep-aid technology through a new partnership with Indiegogo for the development of Sleepbuds. These sleepbuds are worn in the ear and play soothing noises to block out loud background noise. They are accompanied by the Bose Sleep App that enables users to personalize the experience by customizing the Sleepbud settings.

Research Suggests Spider Web Labyrinths Are Effective at Reducing Low-Frequency Noises

New research has shown that the geometry of a spider web can be used to design new structures to reduce low-frequency sounds. In a recent study published in the *New Journal of Physics*, researchers propose a new type of labyrinthine acoustic metamaterials with hybrid dispersion characteristics, by exploiting spider web–structured configurations.

Nissan's Electric Vehicles Will Sing—"Canto"

At the 2017 Tokyo Motor Show, Nissan introduced the world to the future sound of Nissan's electric vehicles. The sound is called "Canto"—derived from the Latin for "I sing"—and varies in tone and pitch depending on whether the vehicle is accelerating or decelerating. The purpose of Canto is to alert pedestrians, or other vulnerable road users, to the presence of the vehicle.

NIOSH Release Update to Sound Level Meter App for iOS

The National Institute for Occupational Safety and Health (NIOSH) in the United States has released an updated sound level meter app for measuring sound levels in the workplace. Its aim is to help reduce occupational noise-induced hearing loss and is freely available on the iOS operating system. The app was tested and verified for accuracy (± 2 dB) against a reference type 1 Sound Level Meter at the NIOSH Acoustics Laboratory.

European Commission Assembling Noise Expert Group

The European Commission is opening up its formal Noise Expert Group beyond Member States authorities and other public entities to allow for a broader discussion on the future of the environmental noise policy of the EU. Stakeholders from industry, infrastructure managers, representatives of civil society, and representatives of groups of citizens whose health is affected by noise have been invited to apply for membership.

Ambulances in NYC Exploring New Sirens

Ambulances in NYC are testing out European-style sirens that alternate between high and low pitches in an effort to alleviate noise complaints. In the U.S. the traditional siren is called the wail, whereas the European siren seems to be more melodic to the ear.

Church Bells Silenced after Almost 250 Years

Church bells in Sandwich, a town in Kent, United Kingdom, which have rung since 1779, are to be silenced due to a complaint over noise pollution. The church bells usually chime every 15 minutes, but will now be silenced at nighttime between the hours of 23:00 and 07:00. Interestingly, over 3,500 people signed a petition to actually keep the bells in the Norman church ringing!

Technology for a Quieter America Workshop—Commercial Aviation: A New Era

In May 2017 the National Academy of Engineering hosted a workshop titled *Commercial Aviation: A New Era.* It was organized by the INCE Foundation in cooperation with the National Aeronautics and Space Administration (NASA) and the Federal Aviation Administration (FAA). The organizing committee consisted of Adnan Akay, Provost of Bilkent University; Gregg G. Fleming, Volpe Transportation Systems Center; Robert D. Hellweg, Hellweg Acoustics; George C. Maling, Jr., Member, NAE; and Eric W. Wood, Acentech Incorporated.

The workshop program and list of attendees is freely available for download via both the National Transportation Library and the INCE-USA website (here). This overview will be followed by a full report of the workshop that includes a summary of each presentation and images of selected slides shown at the meeting. The report coverage will be broader than the relevant chapter of the Technology for a Quieter America (TQA) NAE report published by the National Academes Press in 2010. That report covered NASA technology goals for America as well as European noise technology. It also contained recommendations for action by NASA and the FAA.

INTER-NOISE 2017

INTER-NOISE 2017, the 46th International Congress and Exposition on Noise Control Engineering, was held on August 27–30, 2017, at the Hong Kong Convention and Exhibition Centre. Seven hundred and two (702) oral technical presentations were given at the conference. There were seven hundred and eighty-nine (789) papers distributed to conference attendees in the proceedings thumb drive. This conference was organized by Mr. Tom Ho, Co-Chair, Hong Kong Institute of Acoustics (HKIOA), and Prof. Le Cheng, Co-Chair and Proceedings Editor, Hong Kong Polytechnic University (HKPolyU). Also assisting with the organization and administration of the conference were: Dr. Kin Cheng, Secretary, HKIOA; Dr. Randolph Leung, Secretary, HKPolyU; Dr. Honglian Li, Secretary, NVH-SAE, China; and Prof. Jun Yang, Secretary, Acoustical Society of China.

The contributions to this conference came from around the world. There were 40 regions represented with large contributions from China, Hong Kong, Japan, Korea, Germany, and the United States. There were a total of 1,187 registrants at this Congress. With 112 sessions housed in the convention center, the Congress was well organized and quite successful.

Opening the Conference

The opening events for the conference were held on Sunday afternoon, August 27. Tom Ho, as Co-Chair, began the ceremonies thanking those in attendance and apologizing for the typhoon that made travel to the conference difficult for some (see Figure 1). This brief introduction was followed by a presentation by Kam-sing Wong, the

Figure 1. Conference Opening by Tom Ho

Figure 2. Kam-sing Wong, the Hong Kong Secretary for the Environment

Figure 3. Professor Li Cheng, Congress Technical Chair

Figure 4. Ms. Grace Kwok, the President of the Hong Kong Institute of Acoustics

Figure 5. Marion Burgess, I-INCE President

Hong Kong Secretary for the Environment, who underscored the importance of noise control to the people and government of Hong Kong (see Figure 2). Professor Li Cheng followed Mr. Wong, providing more information on the Congress and the partners involved in organization process (see Figure 3). Ms. Grace Kwok, the President of the Hong Kong Institute of Acoustics, was next to speak (see Figure 4). Ms. Kwok talked about the coordination among different organizations that made this Congress possible and so successful. The final opening speaker was Marion Burgess, the President of the International Institute of Noise Control Engineering (I-INCE) (see Figure 5). Mrs. Burgess welcome those in attendance and thanked the organizers for their hard work in putting together this Congress. She also highlighted the work of I-INCE to support Young Professionals in attending and participating in the Congress.

Mrs. Burgess's presentation was followed by a Lion Dance Performance to provide a traditional opening and welcome for all those in attendance. This was a spectacular performance that was an experience for all in attendance (see Figures 6 & 7).

Figure 6. Lion Dance Performers at Opening Ceremony

Figure 7. Lion Dance Performers at Opening Ceremony

Following the entertainment, Bob Bernhard discussed the upcoming memorial session for Bill Lang at INTER-NOISE 2018 in Chicago (see Figure 8). He provided some stories about Bill and his key role in starting the INTER-NOISE Congress and I-INCE.

The first keynote presentation was by Prof. Xin Zhang, the Swire Professor of Aerospace Engineering at the Hong Kong University of Science and Technology (see Figure 9). The topic of his talk was "Computational Aeroacoustic Study of Leading Edge Noise." He provided an interesting talk that focused on the leading edge flow noise for propellers and fan blades. Using numerical simulation with flow disturbances considered, it was shown that a detailed understanding of such noise can be developed. His simulation methods allow the separation of the effects of smooth flow and the impact of vortices in the flow stream.

This plenary session was followed by the opening ceremony for the Congress. The organizer's provided a very nice opening reception with a warm welcome to attendees from around the world.

Monday, August 28

The technical program began on Monday, August 28. There were 15 parallel sessions covering a wide array of topics. The second keynote lecture was at 11:00. Brigitte Schulte-Fortkamp's presentation of "Soundscape and Noise Management—a Matter of Lifequality" was an interesting discussion of soundscapes (see Figure 10). She noted the impact of many factors and argued for the need to take a holistic approach. She recommended that soundscape analysis go beyond sound sources by considering other sensory systems, visual aesthetics, geography, and social, psychological, and cultural aspects.

There was a full slate for technical sessions on Monday covering a wide range of topics. The exhibition also opened on Monday. While the plan had been to open the exhibit booths for the Sunday evening opening reception, this was not possible due to the delays caused by the typhoon. With 35 booths, this was an outstanding exhibition spanning interests from instrumentation to building materials. An evening reception was held in the exhibition area and was well attended.

In the afternoon of this first day, the Young Professionals program was conducted by Raj Singh. This session was well attended and included the award of YP grants to 16 young professionals (See Figure 11 and Table 1). There was a reception afterward providing a chance for one-on-one interactions between the young professionals and I-INCE officers

Figure 8. Bob Bernhard Describing Bill Lang Memorial Session at INTER-NOISE 2018

Figure 9. Prof. Xin Zhang Presenting Keynote Lecture

Figure 10. Brigitte Schulte-Fortkamp Presenting Keynote Lecture

Figure 11. Young Professionals Workshop

and board members. The I-INCE's highly successful Young Professionals Grant competition has been offered since 2010 in order for noise control engineering students and young professionals, all typically within the first ten years of their careers, to attend the INTER-NOISE Congress. The goals of the grant are to expose students and young acousticians to senior professionals, give them experience in public presentation and paper writing, and assist them in the development of networking skills.

Overall, 139 grants were awarded between 2010 and 2017 as shown in Table 2. For INTER-NOISE 2017, the I-INCE had allocated 20 grants. Funds for 20 grants (600 EUR per person) have been allocated for INTER-NOISE 2017 and 2018 each. This brings I-INCE's total allocation of funds for the grant and workshop to 88,500 EUR for a period of nine years (2010–2018). As of this writing, 39 countries have been represented. More details about the demographic spread as well as the announcement for the INTER-NOISE 2018 grant competition (to be posted soon) can be found at http://i-ince.org/youngprofessionals.php.

How Does the Grant Program Work?

A call for applications goes out about 9 months before the INTER-NOISE Congress. Rules and other important information are posted on the Congress website as well as on the I-INCE website. These applications are rigorously reviewed by the I-INCE panel. A provisional winners list is compiled and given to the technical program chair and

Table 1. 2017 Young Professionals Grant (I-INCE) Winners

First	Last	Country of Origin	Country of Work/Study
Da-Young	Kim	Republic of Korea	Republic of Korea
Miguel Angel	Moratilla-Vega	Spain	United Kingdom
Yiqiao	Hou	China	USA
Sipei	Zhao	China	Australia
Hyeong Rae	Lee	Republic of Korea	Republic of Korea
Bartlomiej	Kukulski	Poland	Poland
Wei	Huang	China	China
Omer Anil	Tozkoparan	Turkey	Germany
Jens	Mecking	Germany	Germany
Alexander	Klabes	Germany	Germany
Miyu	Hashimoto	Japan	Japan
Tang	Qisen	China	China
Merve	Esmebasi	Turkey	Turkey
Fanyu	Meng	China	Germany
Xuhao	Du	China	Australia
Zhengqing	Liu	China	Australia
Christoph	Struempfel	Germany	Germany
Andrew	Price	Canada	Canada
Yangfan	Liu	China	USA
Guillermo	Quintero Perez	Mexico	Spain

Table 2. Demographics of Young Professional Grants (2010–2017)

Country	Country of Origin	Country of Work/Study
Albania	1	0
Argentina	2	2
Australia	1	5
Austria	2	3
Belgium	4	4
Brazil	2	2
Canada	1	2
Chile	1	0
China	28	7
Czech Republic	1	0
Denmark	0	2
France	4	4
Germany	14	15
Hong Kong	0	1
Hungary	2	2
India	7	3
Indonesia	2	2
Iran	2	0
Italy	5	6
Japan	5	7
Korea	13	10
Malaysia	0	1
Mexico	1	0
Netherlands	5	3
New Zealand	1	2
Pakistan	1	0
Poland	2	2
Russia	1	1
Serbia	4	4
Singapore	0	1
Spain	5	5
Sri Lanka	1	0
Sweden	1	4
Switzerland	1	2
Turkey	6	5
United Kingdom	4	14
USA	7	20
Vietnam	2	0
Zimbabwe	1	0

staff of the INTER-NOISE Congress, and the best of the remaining candidates are put on a waiting list in case a provisional winner is unable to attend the Congress.

The Young Professionals Workshop

Every year we invite all of the winners of the grant to attend the Young Professionals Workshop. During this workshop, grant recipients are presented with a certificate commemorating their achievement while also being given a chance to network and have informal discussions with senior noise control engineers and I-INCE leaders. The program of the workshop at INTER-NOISE 2017 included:

- Overview and I-INCE Mission, by R. Singh, VP, Technical Activities, I-INCE
- Presentation of the I-INCE Young Professionals Grant Certificates, by M. Burgess, R. Singh and O. T. Sen
- How to Network?, by S. Hambric, Pennsylvania State University (USA)
- Perspective of a Young Professional, by O. T. Sen, I-INCE YP Coordinator, Istanbul Technical University (Turkey)
- How to Publish a Paper on Noise?, by S. Bolton and P. Davies, Purdue University (USA)
- EAA Young Acousticians Network and junge DEGA, by C. Adams, Technische Universität Darmstadt (Germany)
- Future Young Professionals Programs, by R. Singh and O. T. Sen

More information is given here: http://i-ince.org/youngprofessionals.php.

Tuesday, August 29

Again on Tuesday there were 15 parallel technical sessions in operation covering a wide range of topics. The first keynote lecture of the day was at 11:00. This keynote was by Steffen Marburg (see Figure 12). The title of his presentation was “Conventional Boundary Element Techniques: Recent Developments and Opportunities.” This presentation thoroughly discussed BEM and its application to difficult problems. Dr. Marburg talked at length about artifacts and potential errors in the formulation and approximations used in BEM. He concluded with a brief discussion of potential future developments in BEM analysis.

Figure 12. Steffen Marburg Presenting Keynote Lecture

Figure 13. Jian Pang Presenting Keynote Lecture

Figure 14. Paul Donavan Presenting I-INCE Lecture

The second keynote lecture was in the afternoon by Jian Pang. The topic was "Trend of Automobile Development and Its Challenge for Noise and Vibration Control" (see Figure 13). This presentation provided a comprehensive overview of automotive trends and the potential impact on noise control design and materials. Topics of discussion included hybrid electric vehicles and autonomous vehicles and the implications for noise control.

Both the technical sessions and the exhibition continued through this day. There was active participation in both with many excellent papers.

Wednesday, August 30

There was a full slate of technical sessions until 3:00 PM on Wednesday. The final plenary lecture was an I-INCE lecture presented by Paul Donavan and was titled "Trend of Automobile Development and Its Challenge for Noise and Vibration Control" (see Figure 14). This interesting talk covered the history of tire/pavement noise with a discussion of both the measurement and the impact of various

Figure 15. Joe Cuschieri and David Herrin Presenting INTER-NOISE 2018

Figure 16. Tom Ho Thanking Participants

road surfaces on noise emissions. In addition, factors effecting the longevity of acoustical performance of road surfaces were discussed.

Following this I-INCE lecture, Joe Cuschieri and David Herrin provided information on INTER-NOISE 2018 and invited all to attend the Congress in Chicago on August 26–29, 2018 (see Figure 15). http://internoise2018.org/index.php.

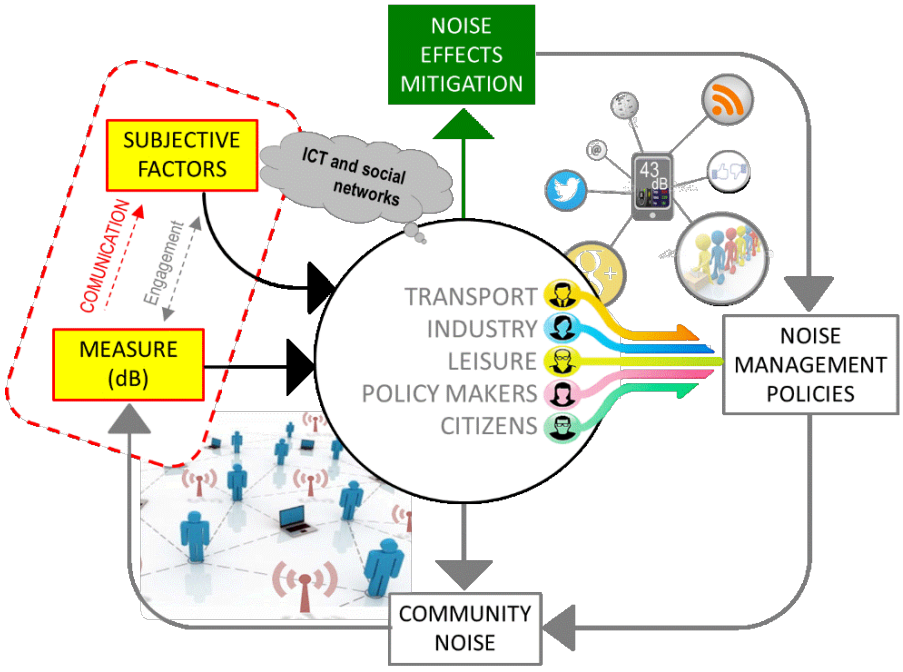
Following this presentation, Tom Ho, the conference co-chair, thanked all those who had participated in organizing and running the conference (see Figure 16). Marion Burgess thanked the entire team who developed and managed the Congress. She then officially closed the Congress (see Figure 17). After the closing, there was a reception sponsored by INTER-NOISE 2018.

Figure 17. Marion Burgess Thanking INTER-NOISE 2017 Volunteers and Staff

Policy Making 3.0 in Noise Management

César Asensio*

Editor's Note: *The world is rapidly changing due to ever-evolving digital technologies. We do not know what lies ahead, and it is possible that the future may contain connections between events and trends that no one expects. To prepare for this, and to experiment with forward-looking, participatory, and evidence-based policy-making practices, the Directorate General for Communications Networks, Content and Technology (DG CONNECT) launched the foresight project "Digital Futures." Digital Futures prototyped a new policy-making model, Policy Making 3.0, based on the metaphor of a "collective brain," or emerging collective intelligence.*



Introduction

Policy Making 3.0 was defined as a participatory and evidence-based model that must respond to specific challenges.[1,2] It is based on the metaphor of the "collective mind," and according to it, the legislator and the other stakeholders form a social network to jointly design policies based on two different aspects: (1) Scientific evidence, basically obtained from real-world data (measurements, statistics, models, objective data); (2) The resulting vision of collective aspiration, which is measurable through social networks (emotions, sensations, subjective perception). Policy Making 3.0 is a cyclical and continuous process, whose objective is the definition and continuous adjustment of "joint policies." These policies will have an impact on the real world (individuals, society, economy, environment, etc.), which must be monitored to obtain scientific evidence on which to support the process. Through data mining and statistical tools applied to measurements and other objective data, we will identify trends and challenges. However, this scientific evidence is not enough. Along with the objective data, it is necessary to gather information referring to personal opinions, corporate interests, and pressure groups. These factors draw to the collective's future aspirations, and therefore will have a great influence on the redesign of the policies. We will collect this entire "non-measurable" component through the social networks.

Policy 3.0 and Noise Management

In relation to our studies on non-acoustic factors influencing noise annoyance, the Instrumentation and Applied Acoustics Research Group (I2A2) of the Technical University of Madrid (UPM) proposed in 2015 a theoretical adaptation of the Policy Making 3.0 scheme to noise management.[3]

The main goal in this approach is the mitigation of noise effects on community, beyond the noise reduction. This goal will benefit residents' health and well-being, and it will ease the expansion of transport, economic growth, and job creation deriving from the avoidance of the environmental constraints related to noise. All the stakeholders will benefit

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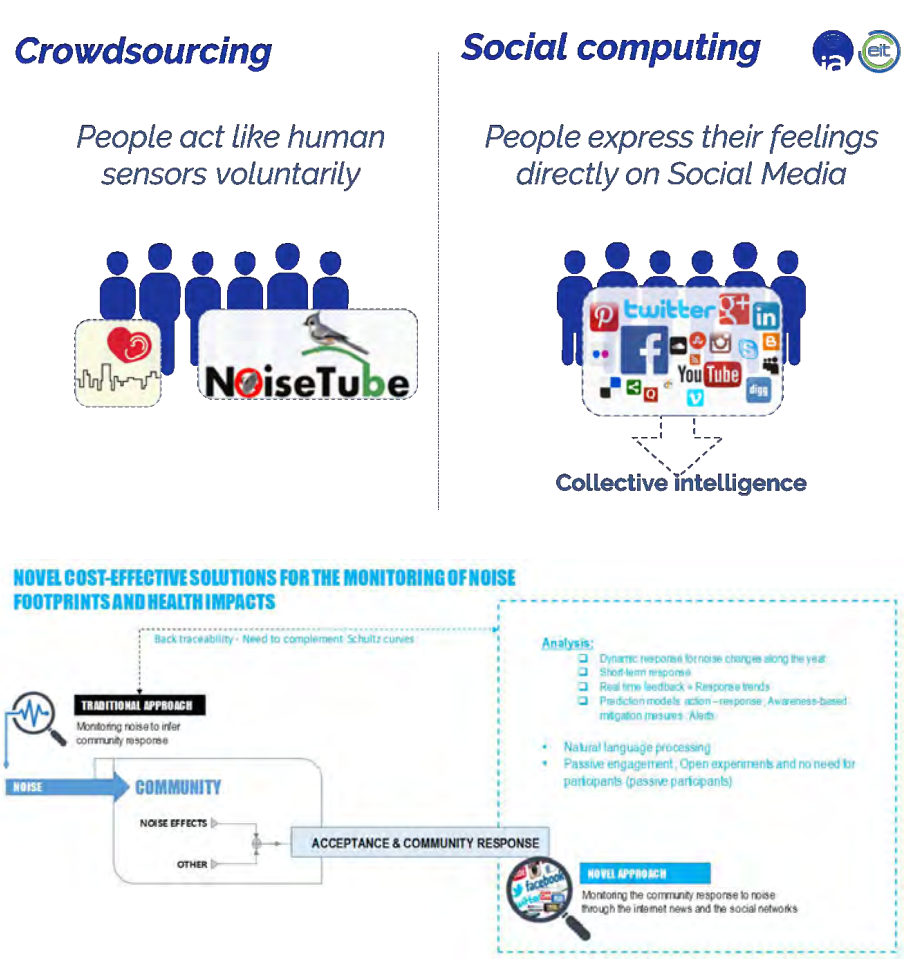
if the main objective is achieved. Furthermore, if the stakeholders work together to conform noise policies, and get involved in the solution, there are more certain possibilities to effectively mitigate noise. To achieve this, it is necessary to raise noise awareness among all the stakeholders. It is mandatory to build an honest relation among them, which is based on transparency and recognition of concern.

The implementation of this model is certainly difficult, but even if it was never implemented, it has several elements that have the potential to be exploited by noise managers in a near future for the mitigation of noise effects on communities:

- Noise monitoring. This element has been traditionally implemented through noise monitoring networks, but nowadays, there is a number of initiatives trying to implement low-cost sensor networks, which claim to accomplish bigger granularity in wider regions. These sensors have achieved a reasonable accuracy and precision, but they probably need a specific and adjusted level of standardization to achieve trustworthiness.
- Improved noise reporting. Bringing information closer to non-experts is crucial to building trust, as non-transparent metrics and over-technical reports may influence the adverse response from community. In addition, noise awareness and recognition of concern are closely related to this issue. Matching community expectations is still a challenge that needs further research.[4,5]
- Participation of stakeholders. The irruption of ICTs and social media offers novel decision-making opportunities in many different fields. Social networks allow giving voice to all citizens, and extending



their audience, which facilitates their organization in groups, expanding the possibilities of generating opinion and debate at different scales (local to international). Their high potential allows us to foresee that, in a near future, these same tools will be used to strengthen citizen participation in decision making, through its direct application to the realization of consultations or referendums (e-Democracy tools). Nowadays there is still a long way to go. There have been some previous initiatives trying to recruit volunteers to gather their subjective response through the social networks (human sensors). Nevertheless, the involvement of participants is not easy when requested. On the other hand, ordinary people are willing to use their social networks to express their feelings and opinions on many different topics, including noise. Conveniently exploited, this passive information provided by participants through Twitter, Facebook, blogs, or online comments will conform the community response to noise. This is live information that can be gathered almost in real time, and analyzed in relation to specific events, actions, policies, sources, regions, and communications.[6,7]

At present, although participatory approaches are gaining more attention, the lack of scientific evidence about their effectiveness and benefits is an impediment to a wider support and funding by authorities and stakeholders, but it is a challenge that our research group is willing to face during

the next years with two active theses on the matter.

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Pan-American News

S.A. Hambric

Current I-INCE Pan American Member Societies

Society
Acoustical Society of America
American Society of Mechanical Engineering, NCAD
Brazilian Acoustical Society (SOBRAC)
Brazilian Association for Acoustical Quality (ProAcústica)
Canadian Acoustical Association
INCE-USA

News and Events

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 2017:

- The spring 2017 meeting was held in Boston, MA, as part of "Acoustics '17," a joint conference with the European Acoustics Association.
- The fall 2017 meeting was held in New Orleans, LA, December 4–8, 2017.

ASA Awards

Recent awards include:

- Adone Lavery—2017 Walter Munk Award for Distinguished Research in Oceanography
- Dan Russell—ASA Student Council Mentor Award

New fellows:

- John Allen, ultrasound contrast agents
- Deniz Baskent, acoustic and electric auditory and speech perception
- Kelly Benoit-Bird, marine ecological acoustics
- Monita Chatterjee, cochlear implant psychophysics and speech perception
- John Culling, measurement and modeling of binaural processing
- John Loverde, building response to sound and impact
- Alexander Ya Supin, hearing and echolocation in marine mammals

ASA Leadership

Marcia J. Isakson of the University of Texas at Austin is the new president and Michael J. Buckingham is the new vice president. The new president elect is Lily Wang of the University of Nebraska and the vice president elect is Scott Sommerfeldt of Brigham Young University.

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

For IMECE2017, NCAD was proud to a sponsor a technical track on Acoustics, Vibration, and Phononics. Over 70 technical talks were given on a variety of topics in noise control and acoustics. Dr. Chris Fuller from Virginia Tech University gave the Rayleigh Lecture, and Dr. Massimo Ruzzene from the Georgia Institute of Technology gave both the NCAD tutorial workshop and the Phononics Plenary talk. IMECE2017 was held November 3–9th in Tampa, FL, USA.

ASME NCAD Awards

The 2017 Per Bruel Gold Medal was awarded to Malcolm Crocker, professor of Mechanical Engineering, at Auburn University, for promoting international collaboration, education, and the dissemination of knowledge in noise control and acoustics through the formation of professional organizations, the establishment of journals and congress series, and the creation of reference volumes for practitioners.

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

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 is preparing 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.

Brazilian Acoustical Society (SOBRAC)

The Brazilian Society of Acoustics brings together individuals (researchers, professionals, and students) as well as public and private institutions (industries, service providers, government agencies, universities) and all those interested in the areas inherent in their work.

SOBRAC Meetings

- The 1st Symposium Fluminense de Acústica—"Acoustics in the Day to Day" was held November 13–14 in Rio de Janeiro. The topics were directed toward a greater understanding of acoustics by those in technology, music, and for the population in general.
- The XXVIII Meeting will be held October 3–5, 2018, at Unisinos—Campus Porto Alegre.

SOBRAC Leadership

The president of SOBRAC is Stelamaris Rolla Bertoli, and the vice president is Debora Miranda Barretto.

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

The 2017 annual conference (Acoustics Week in Canada) was held October 11–13 at the Marriott Delta Hotel and Conference Center in Guelph, Ontario. A special workshop by the Canadian National Research Council was held to address changes to the National Building Code.

CAA Leadership

The current president of the CAA is Frank Russo (Ryerson University), the past president is Christian Giguere (Universite d'Ottawa), and the executive secretary if Robert Racca (JASCO Applied Sciences). Umberto Berardi is editor in chief of the Journal of Canadian Acoustics.

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 2017 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). Both INCE-USA and SAE are looking forward to have another joint meeting in the not-too-distant future.
- INCE-USA will host the 2018 INTER-NOISE in Chicago, IL, August 26–29.

INCE-USA Leadership

Richard A. Kolano, (Rick) of Kolano and Saha Engineers, Inc. serves as INCE-USA president, with Steve Marshall as President Elect.

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.

Asia-Pacific News

Japan

Future and Recent Activities of the INCE/J

2018 Spring Meeting of the INCE/J

The Institute of Noise Control Engineering Japan (INCE/J) will hold the 2018 Spring Research Meeting on April 19, 2018, at Fukagawa-Edo Museum in Tokyo, Japan.

Noise/Vibration/Odor Control Workshop

The INCE/J and the Japan Association on Odor Environment (JAOE) jointly held a workshop "Noise, Vibration, Odor Control Workshop," with the participation of 101 attendees at the National Olympics Memorial Youth Center, Tokyo on October 30, 2017. The workshop was aimed at sharing the latest technology on countermeasures and strengthening the collaboration among local government staffs in charge of controlling noise, vibration, and odor under the sponsorship of the Ministry of the Environment. Five lectures were given on the themes of "Current situation of noise, vibration and malodor complaints," "Countermeasures against malodor complaints," "Noise and vibration countermeasures in administration," "Experience in handling of noise and vibration measuring equipment," and "Handling odor measuring equipment".

Feature Articles in the latest Edition of INCE/J Journal

The INCE/J Journal Vol. 41, No. 5, published on October 17, 2017, focused on "Auditory Guides in Public Space." It contains a general review of "Standardization of Auditory Guides in Public Space" with two review articles "The Present Situation and Problem of Sound Signage in Public Space" and "About Auditory Guiding Signal in Barrier-free Guideline (Passenger Facilities)" as well as 3 technical data reports: "Airport Sound Environment and Sound Sign," "Introduction of Sound Signature of Station, 'Andante' for Ryokuen-Toshi Station, Sotetsu Izumino Line," and "The Present and Future of Audio Signs from the View of a Designer." There is also a commentary "Recent Policy Development on Wind Turbine Noise."

Japanese Industrial Standard C 1509-1:2017

"Electroacoustics—Sound level meters—Part 1: Specifications" (JIS C 1509-1:2017) was published as IDT of IEC 61672-1:2013 by the Japanese Standards Association on September 20, 2017. Drafting was performed by the INCE/J.

Future Activities of the ASJ

2018 Spring Meeting of the ASJ

The Acoustical Society of Japan will hold the 2018 Spring Research Meeting March 13–15, 2018, at the Nippon Institute of Technology (NIT), Saitama Prefecture, Japan (http://www.asj.gr.jp/annualmeeting/ASJ2018springCFP(E).html). The meeting is planned to have the following 11 structured sessions: (1) Measurements and Musical Acoustics, (2) Approach to Road Traffic Noise Reduction, (3) Acoustic Properties Measurement Using Ultrasonic Technology, (4) Evaluation and Imaging of Biological Functions, (5) Progress in Speech Signal Processing with Deep Learning, (6) The First Contest for Teaching Materials on Acoustics, (7) Signal Sound at Station, (8) Current Trends and Issues of Hearing and Accessible Assistive Technology, (9) The World's First Cartilage Conduction Hearing Aid, (10) Immersive Audio and Acoustics, and (11) Sports and Acoustics.

2018 Autumn Meeting of the ASJ

The 2018 ASJ Autumn Research Meeting will be held September 12–14, 2018, at Oita University in Oita Prefecture, Japan.

ISO/TC43 2018 General Assembly Meeting

The ISO/TC43 and its subcommittee SC1 and SC2 are planning to hold their 2018 General Assembly Meetings at the Convention Center "Kunibiki Messe" in Matsue, Shimane Prefecture, Japan on November 12–16, 2018, under the sponsorship of JISC/Japan and ASJ with the support of INCE/J, Matsue City and Shimane Prefecture.

(News sources) Secretariats of INCE/J and ASJ

European News

Euronoise 2018, the 11th European Congress and Exposition on Noise Control Engineering, will be held in Crete on May 27–31, 2018. Euronoise is one of the main conferences organized by the EAA European Acoustics Association, an association gathering more than 30 national acoustic societies from all over Europe. Acousticians and noise experts from all over the world will gather in Crete to discuss recent research outcomes and innovations in noise pollution, noise and vibration control, soundscape, and many related topics.

The EAA will offer grants for the participation and Best Paper and Presentation Awards to young researchers who will present a paper as first author during Euronoise 2018.

The Hellenic Institute of Acoustics warmly welcomes you to Crete for Euronoise 2018. Visit http://www.euronoise2018.eu/.

The John Connell Awards 2017

The John Connell Awards were established in 2001 by the Noise Abatement Society to recognize local authorities, industry, individuals, and organizations judged to have been outstanding in their efforts to both reduce the impact of noise nuisance and seek to pioneer practical and innovative solutions to noise pollution. So far, over 160 recipients from local authorities, industry, organizations, and individuals have been honored for the significant impact they have made to improve the aural environment.

The 2017 John Connell Awards Ceremony was held on October 31 at the Palace of Westminster, London, UK. The awards assigned refer to 6 categories: local authority, soundscape, innovation, quiet logistics, silent approach, and quiet mark. Visit http://noiseabatementsociety.com/john-connell-awards/john-connell-awards-2017/.

New EU Research Projects

Under the funding program H2020-EU.3.4.5.9.—Technology Evaluator, on October 1, 2017, started the research project CLAIRPORT (Clean Sky 2—Airport Environmental Impact Assessments for Fixed-wing Aircraft) with the aim to quantify the environmental impact at airport level of technologies developed in Clean Sky 2 for fixed-wing aircraft. This impact includes noise on ground and population exposed to noise, and emissions and their contribution to air quality. Quantifications are carried out for real European and generic airports, and timescales 2015/2020/2035/2050. CLAIRPORT also aims to impact target stakeholders through customized communication means. Two innovative means are investigated: a noise simulator enabling people to realistically experience sound and visuals of an aircraft flyover in a virtual reality environment, and a serious game addressing the relationship between air traffic volume and environmental impact using reference aircraft versus Clean Sky 2 aircraft. More information can be found here: http://www.cordis.europa.eu/project/rcn/211580_en.html.

Under the funding program H2020-EU.1.3.2.—Nurturing excellence by means of cross-border and cross-sector mobility, on October 1, 2017, started the research project DysTrack (Brain-speech tracking in noisy conditions: toward the identification and remediation of dyslexia). Dyslexia is a developmental disorder leading to reading difficulties. It affects 5–12 % of children and young adults. Dyslexia appears to be frequently linked to hindered phonological processing at the cortical level, with drastic consequences in the presence of noise. The overarching goal of this project is to better understand cortical speech processing in the presence of noise, in order to provide novel identification and remediation methods for dyslexia. More information can be found here: http://www.cordis.europa.eu/project/rcn/209523_en.html.

Under the funding program H2020-EU.3.4.—SOCIETAL CHALLENGES—Smart, Green And Integrated Transport, on December 1, 2017, will start the research project ARTEM (Aircraft noise Reduction Technologies and related Environmental impact). ARTEM aims at the maturing of promising novel concepts and methods that are directly coupled to new low noise and disruptive 2035 and 2050 aircraft configurations. A core topic of ARTEM is the development of innovative technologies for the reduction of aircraft noise at the source. The approach chosen moves beyond the reduction of isolated sources as pure fan or landing gear noise and addresses the interaction of various components and sources, which often contributes significantly to the overall noise emission of the aircraft.

Secondly, ARTEM addresses innovative concepts for the efficient damping of engine noise and other sources by the investigation of dissipative surface materials and liners. More information can be found here: http://www.cordis.europa.eu/project/rcn/212367_en.html.

Under the funding program H2020-EU.3.4.—SOCIETAL CHALLENGES—Smart, Green And Integrated Transport on October 1 started the research project ANIMA (Aviation Noise Impact Management through Novel Approaches). Aircraft noise continues to cause adverse effects on quality of life and public health in airports' neighborhood. To address this challenge and ensure airports will have the capability to respond to the growing traffic demand, ANIMA aims to develop new methodologies and tools to manage and mitigate the impact of aviation noise, improving the quality of life near airports while facilitating airports growth and competitiveness of the EU aviation sector within the environmental limits, also considering 24/7 operations. More information can be found here: http://www.cordis.europa.eu/project/rcn/212369_en.html.

EU Research Projects—Results in Brief

The EU-funded project DREAMS (Dereverberation and reverberation of audio, music, and speech) combined research and training in the field of reverberation and dereverberation. Specifically, the team studied problems concerning modelling, controlling, removing, and synthesizing acoustic reverberation. The purpose was to enhance the quality and intelligibility of audio, music, and speech signals. Researchers developed new algorithms that either remove or add reverberation to audio signals and improve sound quality. More information can be found here: http://www.cordis.europa.eu/result/rcn/203933_en.html.

The EU-funded project ROSANNE (Rolling resistance, skid resistance, and noise emission measurement standards for road surfaces) shows that controlling skid resistance, noise emission, and rolling resistance of pavements can make road transport safer and more environmentally friendly. More information can be found here: http://www.cordis.europa.eu/result/rcn/202139_en.html.

EU-funded scientists have been working on the project ACcTIOM (Advanced pylon noise reduction design and characterization through flight worthy PIV). Addressing this challenge, they invented new active flow control strategies to minimize contra-rotating open rotor CROR-induced noise through a combination of aerodynamic optimization of the propeller pylon shape and the development of an innovative active flow control system to erase the pylon wake before it interacts with the CROR blades. More information can be found here: http://www.cordis.europa.eu/result/rcn/147211_en.html.

The EU-funded ENNAH (European network on noise and health) project established a research network of experts and reviewed existing literature on noise exposure and health to determine the impact of environmental noise. The aim was to identify knowledge gaps in research and examine whether noise maps can be used to establish the adverse health effects of exposure to noise.

Project partners reviewed the advantages and disadvantages of noise maps and recommended future changes to make the maps more appropriate for health research. Researchers also considered new methods for acoustic measurement and modelling to help develop innovative exposure measurement techniques for future studies. Standardization of health outcome measures in noise research was discussed and the priorities for future research on environmental noise and health were defined. More information can be found here: http://www.cordis.europa.eu/result/rcn/90480_en.html.

Book Reviews

Industrial Noise Control and Acoustics

Randall F. Barron
CRC Press, Taylor & Francis Group (reprint of Marcel-Dekker), Boca Raton, (2002)
522 pp., hardbound, 237.60 USD
ISBN: 9780824707019

This is an excellent book that can be used not only as a textbook by students but also as a reference text by practicing noise control engineers. The book has ten chapters.

- Chapter 1 introduces the three-component approach to noise control, namely, at the source, along the path, and at the receiver.
- Chapter 2 provides the important fundamentals of acoustics.
- In Chapter 3, the various acoustical measuring instruments are described in addition to describing sound power measurements and various reference environments.
- The topic of transmission of sound is found in Chapter 4. This chapter, in addition to the modeling for transmission loss of a single wall, describes the modeling for transmission loss of composite walls.
- In Chapter 5, the procedures for determination of noise levels from various types of mechanical sources as well as transportation sources, namely, cars and trains, are described.
- Chapter 6 describes the acoustic criteria and guidelines in various spaces, including aircraft noise criteria.
- Chapter 7 describes the room acoustics. Analysis of acoustic barriers located both indoors as well as outdoors is described in this chapter.
- The topic of silencer or muffler design is described in Chapter 8. This chapter includes both reactive as well as dissipative mufflers.
- Chapter 9 describes modeling and analysis of vibration isolation based on the well-known single-degree of freedom system and two-degree of freedom application to dynamic vibration isolation. This chapter also includes a good discussion of vibration isolation materials.
- Chapter 10 is an interesting chapter that includes seven case studies in noise control. The case studies are from industrial noise control applications. The case studies are described in structured fashion, namely, in five steps. First, the noise control case is described. In the second step, the analysis is given. The third step describes the selected noise control approach. The fourth step deals with the cost. Then, the fifth step discusses pitfalls or potential problems to be avoided in the corresponding case.

A very useful feature of the book is that several example problems are worked out in detail in each chapter. Each chapter has an excellent set of assignment problems that include both conceptual and practical types. I would have liked to see something helpful to students: the answers to the assignment problems included. A good list of references is included for each chapter. The figures are very clear. The book has a good set of appendices including absorption coefficients of various materials. In summary, this book is a highly welcome addition to the list of textbooks.

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Transducers and Arrays for Underwater Sound (2nd edition)

John L. Butler and Charles H. Sherman
Springer International Publishing, Switzerland, (2016)
680 pp., hardbound, 129.00 USD
ISBN: 978-3-319-39042-0

This book is addressed to students, engineers and scientists who use or design transducers and arrays of transducers for underwater sound. The text covers important topics for underwater acoustics, theory, and applications within its 12 chapters. An ample appendix is organized as the 13th chapter and provides additional background information. The book conveys the expertise of the authors, known for their research at US Navy and their academic work in several US Universities. Sample exercise calculations for the discussed topics are inserted in the text. Problems and questions are included at the end of each chapter to be answered by the readers. The solutions to the odd-numbered exercises are provided.

Chapter 1 briefly presents a historical review of underwater sound transducers and arrays of transducers along with a survey of their applications. The authors discuss in a unified way the main aspects on the electroacoustic conversion for six types of transduction mechanisms, which will be analyzed in the text:

1. piezoelectric,
2. electrostrictive,
3. magnetostrictive,
4. electrostatic,
5. variable reluctance and,
6. moving coil.

The transducer characteristics briefly discussed here are the electromechanical coupling coefficient, the transducer response, the directivity index, and the source level.

Chapter 2 discusses in detail the six types of transducers. The electromechanical equation of motion is deduced for each type of transducer. In the case of the piezoelectric transducers, the equations for the 31-mode and 33-mode longitudinal vibrators are provided. A comparison of the fundamental features of the transduction mechanisms is provided, which helps selecting the suitable transducers for different applications. The text presents equivalent circuits for the analysis of the electroacoustic transducers and discusses, based on equivalent lumped circuits, the main parameters of transducers: the resonance, circuit quality factor, bandwidth, tuning, powering factor, power limits, and efficiency. Topics on the circuit and noise analysis of a hydrophone are also discussed. The text also presents fundamentals on the thermal analysis: a lumped model for the thermal process and means for calculating the power and heating of a transducer at resonance.

Chapter 3 deals with models and methods used in the analysis of transducers: the lumped-parameter models and equivalent circuits, the distributed models, matrix models, and finite element models. The lumped-parameter models consist in equivalent circuits for transducers seen as single degree or two-degree of freedom mechanical resonators. The text presents distinctly the equivalent lumped circuits for piezoelectric ceramic and magnetostrictive transducers. The effects of Eddy currents in the analysis of the magnetostrictive transducers are also briefly discussed. Distributed mechanical models are explained based on the infinitesimal analysis of the mechanical bar. The reader can learn to deduce the equations, which describe the vibration of a mechanical bar and how this model is extended to a series of bars connected together. The equivalent circuit for the piezoelectric distributed parameters is separately discussed, with further details for different vibration modes of the mechanical bar, for thickness mode plate and for the magnetostrictive rod. The matrix models reveal the benefits of the matrix representation of the mechanical distributed circuits seen as two-port or three-port structures. The discussions on the finite element models introduce the reader into the advanced methods for the analysis and design of electroacoustic transducers. Modern high-speed computers and special software perform finite element analysis (FEA) for finite element models that allow determining, for instance, the behavior of the variable cross-sectional bars. The text discusses the FEA matrix representation, the inclusion of a piezoelectric finite element in modeling, FEA for magnetostrictive elements, FEA in air and in water loading conditions, and means of shaping equivalent circuits for the FEA models.

Chapter 4 discusses the most important characteristics of any transducer: the resonance frequency, the mechanical quality factor, the characteristic mechanical impedance, the electromechanical coupling coefficient, and the figure of merit with specific aspects for projectors. The mathematical modeling of any transducer involves material characteristics and the equivalent circuits developed before. Along with the definitions found in the literature for the mechanical quality factor, the text quantifies through rigorous math the effect of the mass and the influence of the mechanical resistance on the quality factor of the mechanical bar. Similarly, when discussing the electromechanical coupling coefficient, the text provides the energy definitions found in the literature along with a rigorous analysis of the elements. which can influence the coupling coefficient.

Chapter 5 is wholly dedicated to projectors, the transducers that produce sound for the underwater applications. After presenting the principles of operation for projectors, the text defines figures of merit and evaluates ways of improving the design of these transducers for various applications. The authors discuss the following projector types: ring, cylindrical, spherical, piston (Tonpilz), transmission line, flextensional, flexural, modal, and low profile piston transducers. The text develops equations of motion, provides equivalent circuits, and calculates coupling coefficients, mechanical quality factors, resonance frequencies, and other main parameters. The authors discuss constraints and practical solutions for each type of projector, making clear how to adopt the best transducer for a real-life application. The reader can find under the main categories listed above the thorough analysis of over 25 projector models, from classical makes to recently designed ones. The authors recommend bibliography to the readers who want to learn about projector types not found in the text, such as historic models or designs, which do not fit the six transduction mechanisms considered in this book.

Chapter 6 discusses the hydrophones, transducers that are intended to convert the underwater sound into electrical signals. In principle, any projector can transform acoustical signals into electrical ones. Moreover, there are applications where the transducers are used in dual projector/hydrophone mode. However, specific demands, such as the wide frequency band needed for the acoustic receivers and the passive sonar applications, require specially designed transducers to be used as hydrophones. The text describes the principles of operation and deduces equations for the sensitivity and figure of merit for hydrophones. For the transducers, which are used both as projectors and hydrophones, the text deduces the equation that links the transmitting voltage response in projector mode

and the receiving voltage sensitivity in the hydrophone mode. The discussion continues with the analysis of four main transducer types: cylindrical, spherical, planar, and bender hydrophones. The text also presents the category of vector hydrophones, which are sensitive to both the magnitude and the direction of the acoustic wave. In this group discussed are the dipole vector, pressure gradient vector, velocity vector, piezoelectric multimode vector, summed scalar and vector sensors, and the intensity sensors. For investigating the hydrophones in their environment, the text defines a plane wave diffraction constant and graphically presents values for this parameter in the case of four hydrophone models. A formula given in the text relates the diffraction constant, the directivity factor, and the radiation resistance of the hydrophones. The discussion is completed with a thermal noise analysis. The text provides a comprehensive noise model for hydrophones, including details on the vector sensors susceptibility to local noise.

Chapter 7 deals with the arrays of projectors. The authors discuss the composite structures of projectors for naval applications and refer practical aspects, constraints, and problems that arise when multiple projectors are operating close to each other. The product theorem given in the text allows calculating the far field created by planar or line arrays formed of identical transducers with the same orientation. Then, the text develops equations for determining far field directivity functions for the line, rectangular and circular arrays. The grating lobes of several arrays are analyzed, along with solutions for reducing the side lobes and optimizing the shape for the directivity functions of the arrays. The mutual radiation impedance between transducers is defined for resolving the array equations and for determining the performance of a given array. The text deduces the mutual radiation impedance for planar arrays of piston transducers and discusses basics for the radiation impedance in the case of nonplanar arrays. For the arrays of non-fixed velocity distribution transducers, the authors present a modal analysis of the radiation impedance. The discussion is extended to the volume arrays, which radiate from two or more sides. As an example, the radiation impedance is calculated for a system of two pulsating spheres. The near field aspects for the projector arrays are also discussed. The text shows that the complexity of the array structures impedes the accurate modeling of the near field. However, the finite element analysis can provide approximate guidance in design for the near field problems. The chapter is completed with the analysis of the nonlinear parametric arrays and doubly steered arrays.

Chapter 8 presents the hydrophone arrays. After a general presentation of these arrays, the authors investigate the main topics regarding the directional response, gain, noise and methods of reducing the noise in arrays of hydrophones. Specifically, the directional response of a hydrophone array involves the analysis of directivity functions, beam steering and shading techniques. For determining the gain of the array, the text defines and uses in calculations cross correlation functions. The discussions on noise include the characterization of the main sources (ambient sea noise, structural noise, and flow noise) along with techniques of reducing the noise of the array from each of the sources mentioned above. For the arrays of vector sensors, evaluated are the main directivity properties and the behavior of the arrays against the ambient noise. Another topic refers the noise in the case of the hull-mounted arrays. The text argues the modeling deduces signal to noise ratio formulas, and shows experimental results from such mountings. The chapter ends with the analysis of a steered planar circular array of hydrophones.

Chapter 9 discusses calibration aspects, procedures, and means for evaluating and measuring the main parameters of the transducers, both projectors and hydrophones. The measurements are made in air or water loading, near field or far field conditions for the transducer under test. The text shows equivalent circuits and equations for determining the impedance and admittance parameters for the electric field and magnetic field transducers and describes measurements for resonance frequencies, effective dynamic coupling coefficient, and electromechanical turns ratio. The measurements in water reveal the influence of the water loading on the resonance frequencies, mechanical quality factor, the efficiency coefficients, and the acoustic response of the transducers.

The text presents the reciprocity calibration by using the transducer transfer matrix and develops equations for the reciprocal parameters. A way of optimizing the performance of the transducers during the calibration tests consists in electrically tuning their responses. The text gives details on this technique for electric field and magnetic field transducers. Another discussed topic regards the near field measurements on transducers, which are convenient to be made. After establishing the far field for a projector or hydrophone at the so-called Rayleigh distance, the text describes measurements in tanks and discusses the near field to far field extrapolations for small and large sources. The effect of transducer housings on measurements is also discussed. At the end of this chapter, the authors present a list of transducers developed and calibrated at US Navy for serving as standards in calibrating other transducers.

Chapter 10 is dedicated to the acoustic radiation from transducers. After

presenting the core problem for the acoustic radiation of a vibrating sphere with detailed modeling in rectangular, cylindrical, and spherical coordinates, the authors develop the theory of the far-field radiation from a line source and from flat sources in a plane (point sources, flat circular piston, and rectangular piston). The theory includes deducing the Rayleigh integral equation and calculating the far field patterns for the line sources and a circular piston. The spherical and cylindrical sources are also discussed, with details on their far field beam patterns. The analysis continues with the evaluation of the near-field radiation on the axis of a circular piston, the near field of circular sources, and the effect of the near field on cavitation. Special attention is given to the radiation impedance, which is a main characteristic for the acoustic field of a transducer. The text deduces formulas for the radiation impedance of spherical sources and circular sources in a plane. This chapter concludes with the analysis of the acoustic radiation from a small dipole transducer in the presence of a small passive monopole radiator.

Chapter 11 presents the main equations and formulae developed for physical sciences and adapted for use in acoustics. This chapter is of real help for those who want to thoroughly understand the content of this book, aiming to further research on electroacoustic transducers. A main subject regards modeling of the mutual radiation impedance for piston transducers on a sphere and piston transducers on a cylinder. The analysis uses spherical and cylindrical coordinates and involves Legendre polynomials, Hankel and Helmholtz equations, Fourier and Hilbert transforms, along with other special math functions. The Green's theorem is used to demonstrate the acoustic reciprocity theorem. Then, the Green's function solutions are used for acoustic problems with boundary conditions such as calculating the radiation from the line or plane sources. A special problem regards the scattering of waves from rigid objects. The text develops solutions for the scattering of the plane wave from a sphere and from an infinitely long cylinder and calculates diffraction constant formulas. The mathematics includes Helmholtz integral equation, Legendre polynomials, and Bessel and Hankel functions. The authors discuss numerical methods developed for applying the special math functions in the engineering analysis and cite the new field in acoustics research named "boundary element methods."

Chapter 12 deals with the nonlinear mechanisms and their effects in the analysis of the transducers. In a simplified approach, the discussions in previous chapters considered that the vibrating elements behave linearly at least in a small range for the mechanical

and electrical signals. However, there are deviations from the linear rules and the nonlinear mechanisms are discussed in this chapter for lumped parameter and distributed parameter transducers. The equations of motion are rewritten by considering additional relations between the electric or magnetic field quantities and the movement of the vibrating elements. This way, the linear differential equations of motion turn into nonlinear equations and the solutions reveal new details for analysis. The text discusses nonlinear mechanisms and develops nonlinear equations of motion for the piezoelectric, electrostrictive, magnetostrictive, electrostatic and variable reluctance, and moving coil transducers. The main effect of the nonlinearities consists in harmonic distortions, which are thoroughly analyzed. The text shows that the nonlinearities may create even instabilities in the case of electrostatic and variable reluctance transducers. The chapter ends with the nonlinear analysis of a distributed parameter transducer. In this case, the modeling of phenomena leads to nonlinear partial differential equations rather than ordinary differential equations.

Chapter 13 is an appendix that provides handy information for the reader, such as unit conversions, physical constants, materials used for manufacturing of transducers, various coefficients, and small signal properties for piezoelectric and magnetostrictive materials, etc. The addendum includes basic math for time averages, power factor and intensity, complex algebra, integral transforms (Fourier, Hankel, and Hilbert), basics for electric and magnetic circuits, Thevenin and Norton circuits, modeling of cables, and transformers. The appendix also includes a brief discussion on stiffness, mass and resistance for the piezoelectric transducers, and characteristic parameters for piezoelectric ceramics, and presents the development of a hydrophone noise model.

Through the whole content, with detailed analysis and rigorous math, accurate modeling and numerous references in each chapter, *Transducers and Arrays for Underwater Sound* authored by John L. Butler and Charles H. Sherman is a very valuable text. This book is recommended to all those who are connected to the theory and practice of the underwater acoustics.

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Automotive NVH Technology

Anton Fuchs, Eugenius Nijman, and Hans-Herwig Priebsch, Editors
Springer, NY, (2016)
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This specialized book is a highly welcome addition to the literature on Noise, Vibration and Harshness (NVH) technology for automotive industry. It is known that NVH technology has become very important for the automotive industry as there are several demands such as environmentally friendly "green" vehicles, use of lightweight materials, downsizing of internal combustion engines, efficient transmission technology, etc. Numerical and simulation methods are also used extensively in the automotive industry.

The editors have done an excellent work in bringing the recent advances in some of the topics in NVH technology. The specialty of the book is that most of the chapter contributions are based on the scientific papers presented at the 8th International Styrian N.V.H. Congress in Graz, Austria in 2014. The book is structured into seven chapters that are authored by NVH experts. The chapters focus on aeroacoustics, characterization and reduction of noise from downsized engines, noise of electrified power-trains, practical aspects of cylindrical near-field acoustical holography, acoustics of geared systems, lightweight exhaust systems and a sub-structuring method that allows the dynamic interaction analysis between car body structure, the poroelastic trim material and the interior cavity.

Each chapter title describes well the contents in that chapter.

- The first chapter deals with "*Assessment of the Vehicle's Interior Wind Noise Due Measurement of Exterior Flow Quantities in Early Project Phases*."
- The second chapter describes "*Sound Optimization for Downsized Engines*."
- The third chapter deals with "*Reducing Noise in an Electric Vehicle Powertrain by Means of Numerical Simulation*."
- The fourth chapter deals with "*Cylindrical Nearfield Acoustical Holography: Practical Aspects and Possible Improvements*."
- The fifth chapter deals with "*Vibro-Acoustic Analysis of Geared Systems—Predicting and Controlling the Whining Noise*."
- The sixth chapter deals with "*Possibilities and Constraints for Lightweight in Exhaust Systems*."
- The seventh chapter describes "*A Patch Transfer Function Approach for Combined Computational–Experimental Analysis of Vibro-Porous-Acoustic Problems*."

Each chapter has a nicely written abstract at the beginning and end with either a summary or conclusion that helps the reader. Each chapter has several very clear figures and a list of references. The book will be highly useful not only for NVH engineers and researchers but also for those in automotive industry in general.

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Wave Propagation in Material and Structures

Srinivasan Gopalakrishnan
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This text has an ambitious goal of capturing the multidisciplinary science of mechanical wave propagation covering both the basic and advanced features of wave propagation in a diverse set of materials. This book assumes the basic knowledge of graduate level engineering mathematics, material science, continuum mechanics, and numerical analysis.

Chapter 1 introduces the basic structure of the book, introducing the key difference between structural dynamics problems, where the designer is interested in the long-term effects of the dynamic load involving the first few normal modes, and wave propagation problems, where short-term effects are of concern, involving many higher order modes. This text emphasizes the latter category of problems. The book also focuses on new methods of wave propagation analysis necessary for efficient nondestructive categorization of elastic media with nanostructures. Chapters 2–8 introduce fundamental aspects of wave propagation while Chapters 9–18 develop the advanced concepts.

Chapter 2 starts by covering the traditional local elasticity theory but quickly introduces the nonlocal theory of gradient elasticity necessary to understand the nanostructure wave guide models. Eringen's stress gradient theory (ESGT) and Laplacian stress gradient theory are covered in more detail. Chapter 3 discusses methods of developing constitutive models for fibrous, particulate, and laminate composite materials. The chapter also introduces functionally graded materials (FGMs) where the percentage content of metal or ceramic is varied in a controlled way to achieve a desired property gradation in spatial direction, first conceived to increase adhesion and minimize the thermal stresses in metallic–ceramic composites. Chapter 4 summarizes the three important integral transforms, Fourier transforms, wavelet transforms, and Laplace transforms, which are the pillars of modern spectral analysis. Chapter 5 discusses the detailed procedures to compute critical parameters such as phase and group velocities and introduces basic concepts such as dispersive and nondispersive waves and critical definitions such transition and cut-off frequencies. Difficulties of accurate computation of wave numbers and group speeds in complex media and nanostructures are pointed out and possible solution methods are outlined. Chapters 2–5 complete the basic understanding of the concepts necessary to proceed to the remaining chapters. However, as pointed out before, this text only provides a summary of the concepts. To master the material, the study of other texts would be necessary.

Chapter 6 discusses the wave propagation in 1-dimension isotropic waveguides (rods, beams, and frames) including tapered and rotating guides. The effects of additional constraints such as elastic constraints, elastic foundation and pretension on the wave propagation are treated. Chapter 7 discusses 2-D isotropic waveguides (membranes and plates) along with wave propagation in doubly bounded media. Special consideration is given to Rayleigh waves important in seismic engineering. The chapter points out the increasing difficulty (and thus the need for spectral methods) in obtaining numerically accurate solutions, as degrees of freedom increase. Chapter 8 studies the laminated composite waveguides where traditional Helmholtz decomposition used for isotropic solids is not applicable due to the coupling of longitudinal and transverse waves. Partial wave techniques are introduced as means of solution particularly considering effects of damping and cross-section ovaling. Chapter 9 discusses the wave propagation in sandwich structural waveguides that provides enormous increase in the stiffness for the same weight by merely increasing the depth of the core. The higher order analysis methods, e.g., Extended Higher Order Sandwich Plate Theory, that are necessary to account for multiple motions within the structure are addressed. Chapter 10 focuses on carbon nanotube structures employing the previously introduced theories of gradient elasticity while Chapter 11 concentrates on FGM structures.

Chapter 12 introduces new finite element formulations, namely, the super convergent finite element formulation and the time domain spectral element finite element formulation as well as new time integration schemes, namely, the Taylor–Galerkin scheme and energy momentum conserving time integrators. This chapter is supplemented by many numerical examples that illustrate the computational efficiency of these formulations. Chapter 13 discusses all three (Laplace, Fourier and wavelet) variants of spectral finite element formulation carefully illustrating with examples the suitability of a particular variant. The remaining chapters expand on these basic examples by focusing on special classes of problems particularly useful for the industry.

Chapter 14 discusses mechanical waveguides with embedded or surface-mounted smart patches where wavescattering considerations are important. Examples of such materials are piezo ceramic material such as lead zirconate titanate (PZT) used in ultrasonic transducers and magnetorestrictive material such as Terfenol used in naval sonar systems. Chapter 15 discusses defective

waveguides that include defects such as delamination and fiber breaks important for structural health monitoring. Chapter 16 extends the methods to study structures with periodic defects typical of many engineering structures. Chapter 17 introduces the readers to the emerging fields (e.g., lighter materials in aerospace industry) where the material properties show significant variation rendering traditional solutions intractable. Chapter 18 focuses on hyperelastic materials such as vulcanized rubbers. The various new finite element formulations are presented with suitable examples.

This book is essentially a compendium of the experience of the author and his graduate students working in the field of applying finite element methods to study advanced materials. The book provides a unifying theoretical perspective that is often overlooked as the students and researchers delve into the nitty-gritty of actual computations. Thus, this volume would be useful to students embarking on this field in search of new research projects as well as to the advisor trying to design courses on this subject. For researchers in other fields of wave propagation, this book will serve as a useful reference and may birth ideas that may successfully cross over to their chosen field of study. Each chapter can be studied independently and is supplemented with a comprehensive list of reference.

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Vibro-Acoustics: Fundamentals and Applications

Dhanesh N. Manik
CRC Press, Boca Raton, (2017)
468 pp., 250 b/w illustrations
Hardbound, 111.96 USD
ISBN: 9781466580930

This is an excellent book and a highly valuable addition to the field of vibro-acoustics. The book is highly suitable not only as a textbook for students in acoustics and vibrations but also as a text for noise control engineers. This will clarify the modeling of sound radiation by vibrating structural components and systems, which is very important for noise control by design. The book uses both modal and wave approaches. With ten chapters, each is very well structured.

Chapter one describes in detail the basics of single degree of freedom system. This chapter also includes description of various vibration transducers. The *second chapter* describes both multi-degree of freedom systems and longitudinal vibration of bars with various boundary conditions. The basics of airborne sound propagation are described in chapter three, which also discusses transducers for sound measurement.

Chapter four describes fundamentals of random vibration and discusses random processes and response of a single degree of freedom system due to an arbitrary excitation. The flexural vibration of beams is dealt with in chapter five. The wave approach and modal density are also discussed in this chapter. *Chapter six* deals with flexural vibration of plates and shells, which are important sources of sound radiation. This chapter includes transmission loss due to barriers. The basic sound sources such as monopoles, dipoles, and quadrupoles are described in *chapter seven*.

Chapter eight describes acoustics of rooms. Various room environments such as anechoic, reverberant, and diffused are discussed in this chapter. Chapter nine describes the important topic of sound–structure interactions. This chapter nicely describes the various concepts such as radiation ratios for various sources, acoustically slow and fast modes from finite plates. *Chapter ten* treats another important topic, namely, statistical energy analysis. The chapter includes several applications in vibro-acoustic system modeling such as aircraft cabin, piano sound production, etc. The chapter also presents statistical energy analysis equations from continuous systems. Discussions of applications such as plate–shell vibratory system, non-resonant transmission between rooms, etc. are included in this chapter.

Each chapter has a nice overview at the beginning and a nice conclusion at the end, which help the readers. Figures and tables are very clear. Each chapter has a good set of sample problems worked out in details emphasizing concepts. Also, a good set of assignment problems is included at the end of each chapter. However, it would have been helpful to students if the answers were provided for the assignment problems. In summary, this comprehensive book is a highly welcome addition to the field of vibro-acoustics. The book is recommended for the libraries of all acousticians.

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Philosophy and Engineering—Exploring Boundaries, Expanding Connections

Diane P. Michelfelder, Byron Newberry, and Qin Zhu, Editors
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Upon initiating this review, I immediately felt fortunate to have the opportunity to consider this specialty area of study. The exposure to philosophy and its links to engineering practice has become a valuable learning experience for this reviewer. The book provides data and

analysis covering a range of formal studies and surveys, as detailed through the contributions of several supporting writers. The summaries and illustrations are very helpful. The editors have done an excellent job of bringing the diverse work of several authors together into a uniform and consistent package. Overall, this book details the connections between engineers and humanists, essentially linking the approach taken by an ethical designer or scientist, with the value and ethics of a philosopher.

Most chapters in the book address the philosophical, ethical, and policy issues emanating from engineering and technology. There are two main themes presented by the editors. First, philosophy provides some valuable insight into the challenges engineers face in working with their peers, policy makers, and other stake holders. Through their day-to-day practice, engineers must address value, reason, and emotion to ensure the social good. Second, engineers operate among certain boundaries, often set by policy makers and others from a range of academic disciplines. Engineers must meet the needs of their customer and the public, through the application of proven concepts and suitable language, while avoiding or minimizing potential obstacles towards the collaboration with other fields. In addition, the book describes the unique moral and philosophical challenges related to emerging fields and technologies.

The key supporting papers included in this book were first presented at the 2014 meeting of the "Forum on Philosophy, Engineering, and Technology," held at Virginia Tech in Blacksburg, Virginia. Contributors explore a wide range of topics over nineteen (19) chapters. The following is a brief overview of the details and depth delivered by the book's authors.

Chapter 1—Philosophy and Engineering: An Unconventional Work in Progress

The opening chapter provides the reader with an outline of the supporting papers and resources used throughout the book, including a description of the vast relationship between philosophy and engineering. There is an interesting look into the future of the developing field of philosophy of engineering, and how it relates to the rapidly evolving field of modern engineering and applied science. Section 1.3 provides an excellent introduction into the forthcoming chapters.

Chapter 2—Pragmatism and Engineering

The practical aspects of engineering science are discussed in this chapter. Engineers are faced with the day-to-day challenge to make an effective decision, even in situations before all scientific questions have been answered. This form of problem solving may appear when examining philosophical issues as well, where one tries to solve a complex situation using proven, practical techniques. The close connection(s) between pragmatism and engineering practice is one of the first topics that highlight the connections between philosophy and engineering.

Chapter 3—Squaring Philosophy of Engineering Through Personal Epistemologies Research

A comprehensive review of a survey of engineers is provided with a focus on personal epistemologies.[1] Through direct interviews, the dimension of a personal epistemology is defined. Table 3.1 is a summary that every engineer and philosopher of engineering should be familiar with to appreciate the contrasting views toward the source, structure, certainty, justification, and sociality of knowledge. This is a chapter that I enjoyed reading a second time, and will likely discuss the findings with colleagues in the future.

[1]The study of knowledge.

Chapter 4—Evidence in Engineering

In the effort to define how we know what we know, engineers may turn to an evaluation of the quality of the information. This chapter provides a review of the history of engineering science, and the concept of applied science as a precursor to modern engineering. There is a detailed review pertaining to the collection and construction of evidence in philosophy, science, law, and engineering. The obvious differences and not so obvious similarities are discussed, including the need for teams of experts to come together and collect, assess, and apply any supporting evidence as part of a final solution or product.

Chapter 5—Is Technology a Science? Recent Developments in German Philosophy of Technology and Engineering

The chapter includes a brief discussion on the key elements of the scientific method and describes engineering as the delivery of the material output from the "scientific way." A discussion and summary follows, toward an advanced understanding of the philosophy of technology and engineering. This includes some helpful historical references. The author describes the virtual border between "pure" and "applied" science. With the apparent rapid expansion of new fields and areas of specialization, engineers are faced with the challenge to meet the acceptance of both a project's proponent (e.g., customer) and the ecological and economic impacts.

Chapter 6—The Role of Technologies in Undermining the Perennial Philosophy

The author describes why and how an engineer may evaluate if adequate

epistemology has been achieved. It seems to depend significantly on the context of the applied science and the application itself. Extensive historical references are provided here, including the context of the early scientific observations made by Galileo. For a typical engineering activity, some form of scientific observation is needed, ideally through framing, measuring and interpreting nature.

Chapter 7—Rethinking the Social Responsibilities of Engineers as a Form of Accountability

An engineer's challenge toward socially responsible is discussed in this chapter. With potentially many actors involved, the engineer must be accountable and strive to clearly describe how those responsibilities are constituted. An interesting discussion is included pertaining to an engineer's social obligations, the depth of these responsibilities, and the relationship to the public's safety, health and welfare. Engineering professional responsibilities, ethics and the role of the whistleblower are included.

Chapter 8—On Ideals for Engineering in Democratic Societies

Engineers may recognize that their decisions have the potential impact on the broader environment and humanity. A discussion is included on how engineering decisions may best encourage human prosperity, equity and democratic goals. Key literature pertaining to scientific decision making and values is included. Society appears to be placing more emphasis on the engineer's ability to handle outside democratic responsibilities and the technical challenges associated with the delivery of work.

Chapter 9—Engineers and the Evolution of Society

The relationship between a professional engineer and the greater society is discussed in this chapter. The philosophical framework for society is described as secular humanism, and forms the basis of the defined role of an engineer working in society. As society evolves, so will humanity's goals for a "better life" and an understanding on what constitutes a good product or service. The chapter describes the interaction between an evolving society and engineers. Figure 9.1 provides an excellent illustration of the relationship between these two groups. Society may express or initiate a need and an engineer may offer options and execute a preferred solution. It then evaluates the outcome of that solution. Results or feedback from that evaluation may help support future work performed by the engineer, to help meet the needs of an evolving society.

Chapter 10—Engineering Rationality and Public Discourses on Dam Construction in China

The author provides a contract of engineering philosophy in the western world and within China. The differences are numerous, no greater than the West's focus on engineering design process, codes, professional accreditation and applied science, versus the focus of Chinese professionals on the delivery of engineering for "building and construction" activities. Engineering practice in China is linked to national pride and a more top-down decision-making process, while the West employs a more referendum style assessment process, especially when large scale projects are under consideration, such as mass transit and dam construction. The author discusses a philosophical approach toward cultivating a kind of "engineering culture," with a focus on a development of the global civilization in the whole society.

Chapter 11—Interdisciplinarity, Incommensurability and Engineering in Policymaking: Using Philosophy to Understand Challenges at the Engineering–Policy Interface

The need to better understand the linguistic, disciplinary, and practical relationships between engineers and policy makers is examined in this chapter. One of the areas for potential conflict includes the procurement process involving engineers, policy makers, and other stakeholders. Often, the triggers for project cost overruns and delays may be attributed to both the language used by the parties involved, and the failure of engineers to communicate the value of the work or tasks to the policy decision makers.

Chapter 12—Ethical Presentations of Data: Tufte and the Morton-Thiokol Engineers

A very common ethical and professional situation encountered by engineers is the presentation of their technical results and data. A real-life example is provided in the chapter, outlining a specific analysis related to NASA's Challenger shuttle tragedy. A fascinating walk-through of the events associated with O-ring failure as it related to the presentation of critical engineering data. The accuracy, suitability, and clarity of the data will help ensure that an end-user makes an informed, engineering design decision. Engineers must take care in making value judgements with respect to disseminating results to customers and related stake holders. The presentation of data is implicit to be a value-laden deliverable. Thus, the engineer must be confident that the values presented or implied are ones that are truly endorsed.

Chapter 13—Empathic Perspective-Taking and Ethical Decision-Making in Engineering Ethics Education

The key topics discussed in this chapter include empathy in an engineering practice and the decision-making process, ethics in an ethically challenging environment, and real-life situations that challenge engineers to deliver an ethically justifiable decision. Engineers may face empathetic challenges, with respect to trying to understand and factor in the needs of others as part of one's own

work. The authors describe an empathic perspective-taking development, in order advance an engineer's empathy, as complementary part of a decision-making task.

Chapter 14—In Praise of Emotion in Engineering
The emotional side of engineering practice is discussed in this chapter. This includes an engineer's ability to analyze their emotions and identify any impacts on engineering ethics. The author describes a successful engineer as one who can control their emotions, during an effort to win others over to their recommendations.

Chapter 15—3D Printing and Anticipatory Business Ethics
The implementation of 3D printing has been rapid, and is changing the nature of the product design process and business overall. This chapter describes the potential impacts of 3D printing on future business, and outlines some anticipated ethical issues. The ease-of-use related to 3D printing allows many stakeholders to engage, influence and change designs to suit a wide variety of needs. The challenges include bringing interdisciplinary groups together, to help ensure ethical and social issues are addressed.

Chapter 16—3-Dimensional Printing in Medicine: Hype, Hope, and the Challenge of Personalized Medicine
The chapter describes some of the unprecedented advancements in 3D printing within the medical industry. This specialized area includes some unique challenges for engineers and practitioners, including product safety, streamlined medical research into practice, special interest groups, and 3D printing of body parts for non-medical uses. The medical industry anticipates a massive deployment of this technology in the future. The author describes a need for an ethical technology assessment. This may be a rapidly emerging area for engineers.

Chapter 17—The Limits of Logic-Based Inherent Safety of Social Robots
This chapter addresses the vast specialty area of human–robot interactions. This includes safely using a social robot, and the responsibilities of the engineer towards public good. The author describes the challenges associated with establishing ethically correct robots and the apparent gap between a robot's logic-based safety and actual human reasoning. The chapter's examples and case studies provide an excellent illustration of this fascinating area of study. The ethical challenges are numerous and present an excellent opportunity for engineers in the future.

Chapter 18—A Historical Perspective on the Epistemology of Contemporary Breakthrough Innovation
Within the fields of technology and engineering, epistemology over the past two centuries has advanced primarily through the efforts of a small group of innovators and talented thinkers. This chapter provides several illustrations of breakthrough innovations, and the key features of a rare innovator. Key attributes of an innovator include: holistic thinking, intimate involvement in the key issues, and a non-linear approach towards achieving new ideas and dimensions.

Chapter 19—Open Innovation and the Core of the Engineer's Domain
There is a greater frequency of innovation within society that does not require the direct contribution of engineers. This chapter considers the role of engineers when they are not fully involved or leading an innovation effort. Through readily available computational modelling, as an example, the author describes open innovation lead by others in society. This includes a discussion on the engineer's domain of influence and responsibility to the public. After all, innovation may be performed by anyone within an open society. As salient partners in this type of innovation, engineers are responsible to maintain ethics, laws and codes, and meet the environmental needs. The engineer's domain appears to be continuously expanding. This book delivers a consistent theme, impressively finding a balance between epistemic-oriented science and action-oriented science. The topics reinforce the nature of effective communications used by engineers. The authors emphasize the value in employing precise and specific language. In addition to an assessment of how we know what we know, a study of philosophy may teach an engineer the value of precise communications. This book is highly recommended, especially for any engineer striving towards continual learning and being the best possible professional in their chosen field.

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Vibration Analysis, Instruments, and Signal Processing

Jyoti Kumar Sinha
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This book was written to help the reader develop an understanding of common methods of vibration analysis and measurements. Starting with the requisite chapter on the single degree of freedom system, it jumps right into finite element analysis (FEA) in the next chapter, using simple dynamic systems for ease of illustrating the theory. The FEA chapter discusses modal analysis using a cantilever beam example and ends with a discussion on damping which I found rather short, considering the importance of damping upon analysis results.

Force response analysis, using FEA, is given an entire chapter on its own, including separate discussions of the direct integration and modal superposition solution methods with discussion of the merits of each approach. The next chapter, "Introduction to Vibration Instruments," provides a good description of the dynamics of displacement, velocity, and acceleration transducers, followed by a discussion on vibration excitation instruments (i.e., instrumented hammers and shakers). The chapter ends with data collection and storage.

The next chapter is dedicated to signal processing. Basic topics are discussed, including time domain signals, filtering, quantification of time domain data (e.g., RMS, crest factor, etc.), calculation of the Fourier transform, Nyquist frequency, and window functions. Data sampling was included in the discussion on data collection and storage in the previous chapter. The next two chapters provide concise descriptions of experimental modal analysis and FEA model updating with examples provided.

Next is a chapter on vibration-based condition monitoring of rotating machines. This reviewer has limited experience in this particular field, but the chapter appears to encompass the necessary topics of measurement and fault detection techniques.

The final chapter provides a variety of case studies that appear to come directly from the author's experience as a vibration analyst. They were chosen to illustrate many of the concepts discussed in the previous chapters.

A strong background in linear algebra and differential equations is necessary in order fully understand many of the concepts discussed in the book. However, the content should be accessible to most advanced undergraduates and graduates pursuing degrees in engineering, physics, or mathematics. The book is not intended to be an encompassing reference. Rather, it provides a good starting point for anyone engaging in research or in a career related to vibration measurement and analysis.

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The Handbook of Contemporary Acoustics and Its Applications

Junru Wu
World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ, (2016)
448 pp., hardback, 158.00 USD
ISBN: 978-981-4651-27

The goal of *The Handbook of Contemporary Acoustics and its Applications*, as stated at the beginning of the book, is to provide an updated, comprehensive reference book for senior undergraduate and graduate students. The book is also an excellent reference for specialists working in relevant fields. This broad goal is made possible by the well-organized contents; the format of which makes it also easy to be used as a textbook for acoustic courses. This comprehensive reference book educates readers on both fundamental concepts as well as their broader applications in the fast-moving technological world. It is in the comprehensive discussion of applications that the understanding of the wave equation can be fully realized for a student studying acoustics.

Chapter one covers the theoretical principle and analytical methodology of excitation, propagation, and interface interaction of acoustic waves in an ideal (inviscid) media in which the acoustic wave has no energy loss as it propagates. The wave equation in this fluid system leads to the discussion of the conservation and thermodynamic laws and their importance in understanding the fluid particle as defined in the wave equation. The understanding of the fluid particle in this lossless media allows the understanding in a dynamic world where energy loss of various forms is inevitable. This chapter also presents the important aspect of superposition and linearization conditions. This is essential in setting the foundation for any student, since often acoustics is modeled in linear conditions. Whereas this makes for easy estimation, it is important to understand when those conditions may not be valid or may be incomplete.

Chapter two begins with a discussion of the Green's function, which is utilized throughout the book for linear acoustics. For an ideal fluid, the determination of the mathematics for the Green's function and the characteristics of the acoustic waves relative to radiation of and scattering from cylinders and spheres, as well as diffraction and reception of the acoustic wave, are important in unveiling of the dynamics of the acoustic waves in the real world. The directivity of the source is specified and then further clarified with figures. This chapter, as well as all others, further explains the dynamics of the acoustic wave in terms of both low and high frequency.

Chapter three then presents the non-ideal fluid media. The last section of chapter three then takes the totality of the information up to this point in the book to then discuss sound propagation in a viscid fluid and biological medium. Chapter four discusses the acoustic field in a finite-size cavity and the reflections from walls with various properties. A standing wave or eigen-mode is provided. Constructive and destructive superposition is important to understanding of potential anomalies. Since this can become very complicated, an approximation method is discussed. Chapter four presents an acoustic field in a duct/ pipe, waveguide and cavity. Dr. Wu typically concludes a chapter by discussing a further application.

This chapter ends with a discussion of biological virus and bacterium cells as spherical resonators and the eigen-modes of vibrations of cells. This section, as the others in the book that examines real world applications, provides further insight into mathematical modeling of these problems. For a student, this could open a world of wonder about acoustics and its applications and the necessary tools to understand the problem better.

Chapter five presents the nonlinear acoustic wave, or finite amplitude acoustic wave. As done throughout the book, the mathematics and concepts are first presented for the least complicated medium and then the author explores more complicated applications and scenarios.

Chapters six through eight delve into propagation and the mechanisms of physical and biological effects and their broad modern applications such as sonoporation and targeted drug delivery, acoustic tweezers, noninvasive high intensity focused ultrasound (HIFU) surgery, and blood–brain barrier disruption, as well as sonoluminescence. Readers are also provided with the fundamental mathematic background and associated references necessary for their creative inventions and applications.

In conclusion, I truly enjoyed reading this book with its extensive application examples. Due to the interesting combined theoretical and direct applications, the book should be beneficial to students, as well as a broad spectrum of practitioners and researchers. I often deal with clients who know very little about acoustics and Dr. Wu's discussion of the linear vs. non-linear aspects of the acoustic wave will hopefully help me to help my clients better understand the importance of this concept.

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Architectural Acoustics Handbook

Ning Xiang, Editor
J. Ross Publishing, Plantation, FL, (2017)
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The title of the book would suggest an all-encompassing reference, which it is not. Instead, editor Ning Xiang has assembled a collection of current architectural acoustics topics written by specialist academics, researchers, and practitioners knowledgeable in their specific field. Several topics have been published only in journals or conference proceedings and having these in a single compendium is most welcomed. Of interest to this reviewer were chapters on acoustics of long rooms and room-related sound representation using loudspeakers.

The book comprises 15 chapters by 17 authors subdivided into two parts: architectural acoustic essentials (Chapters 1 to 11) and architectural acoustics practice (Chapters 12 to 15). Each chapter concludes with a reference list. A brief biography of each author appears at the beginning of the book.

Chapter 1 by U. Peter Svensson, Jonathan Botts, and Lauri Savioja introduces the reader to basic acoustic concepts in computational room acoustics using wave-based modeling including analytic and numerical solutions. The chapter presents a brief, yet concise, summary of these topics.

Geometrical aspects of computational room acoustics modeling by U. Peter Svensson, Samuel Siltanen, and Ning Xiang is the subject of Chapter 2. This chapter complements the first chapter and covers geometrical acoustics, specular reflections and diffraction, and statistical modeling. Practitioners using commercial room acoustics modeling software will benefit from the information in this chapter.

Chapter 3 by Jian Kang summarizes much of the work this author has contributed to the acoustics of long rooms which are characterized as non-Sabine spaces. Covered are the acoustic theory, simulation and calculation methods, design factors, and case studies relevant to these unique spaces. Information in this chapter is directly applicable to the design of long corridors, tunnels, and subway stations.

The acoustics of coupled volume systems, Chapter 4, is explained by Ning Xiang. Topics include wave theory modal analysis and modal expansion methods, statistical and geometrical room acoustics, diffusion equation based techniques, Bayesian energy decay analysis, and scale models. This material is applicable to the design of variable acoustic concert halls, large spaces with niches, and worship houses with connected chapels.

Chapter 5 by Wolfgang Ahnert and Stefan Feistel covers advanced measurement techniques in architectural acoustics with examples from commercial acoustics measurement software. The chapter starts with measurement basics using Fourier analysis followed by applications to room acoustics and sound reinforcement systems. More specific topics include excitation signals, measurement errors and optimization, time and frequency domain measurements, speech intelligibility, modal analysis, and in-situ sound absorption measurements. Those involved in acoustic measurements will gain insights to the theory behind their measurement platform with this chapter's contents.

Room-acoustic energy decay analysis by Ning Xiang is reviewed in Chapter 6. Starting with Schroeder's integration method for sound energy decay, the concept of a non-linear regression model avoiding background noise is discussed. The chapter concludes with considerations for evaluating coupled volume spaces with dual decay slopes using a combined Bayesian and Schroeder integration analysis.

Chapter 7 by Carl Hopkins addresses sound insulation in buildings. The chapter covers the direct transmission paths but emphasizes sound flanking paths that often control sound isolation. Both airborne and structure-borne noise transmission are addressed. Included are many data illustrating direct and sound flanking attenuations as well and typical laboratory test data for a variety of wall and floor constructions. The one omission that would have broadened the chapter's content would have been a summary of rain noise transmission prediction methods that the author has developed. The importance of sound flanking paths and the need for control to avoid compromising sound isolation are key factors in this chapter.

Aspects of auditory perception in rooms written by Jonas Braasch and Jens Blauert are the topics of Chapter 8. Basic concepts for binaural hearing to include time and intensity cues are defined first before progressing to more advanced topics such as spatial impression and the role of early reflections and reverberation, and finally the precedence effect. Binaural room impulse response measurements are covered and metrics such those in ISO 3382-1, as well as the limitations of the room impulse response, are described. The chapter concludes with how the acoustics of a space are processed by humans to determine preference judgements for that space. A new concept, the Quality-of-the-Acoustics, which is used to determine the adequacy of a venue for a specific performance genre, concludes the chapter.

Chapter 9 by Michael Vorländer provides a summary of auralization techniques, the auditory simulation of sounds derived from computer data. Starting with elementary definitions and signal processing techniques, the author then reviews auralization concepts. Covered are source characterization, filter construction for the room impulse response, airborne and structure-borne sound transmission, and finally, spatial sound reproduction. Limiting aspects of this technique are described as requirements for real-time processing. Like Chapter 2, practitioners using commercial room acoustics modeling software will benefit from the chapter's contents.

Room-related sound representation using loudspeakers is covered by Jens Blauert and Rudolf Rabenstein in Chapter 10. This chapter describes different presentation technologies for creating sound simulations for listeners. Described are intensity stereophony, amplitude-difference panning, surround sound, spherical harmonic synthesis, wave-field synthesis, and binaural cue selection. Descriptions for each simulation conclude with a table summarizing its advantages and disadvantages and should aid the end-user in selecting the most appropriate technique.

Chapter 11 on environmental acoustics is reviewed by Jian Kang. Starting with elementary concepts on sound propagation, barriers, and noise mapping, the material shifts to more advanced models for sound propagation to include image source, ray-tracing, radiosity, wave-based, and scale models. Perceptual aspects of noise and urban soundscapes conclude the chapter. While addressing newer concerns in environmental acoustics, this material does not seem to fit within the context of a book on architectural acoustics.

Sound system design and room acoustics written by Wolfgang Ahnert is the subject of Chapter 12. The author first covers room acoustic properties applicable to sound system design since room acoustics affects sound system performance. Speech intelligibility is reviewed followed by requirements for music reproduction. Sound propagation in open spaces and, by inference, the direct sound field in a room are described followed by sound system limitations. The longest section details design requirements for sound systems. Included are descriptions of the major loudspeaker types, microphones, and signal processing equipment. The last part of the chapter covers calculations and computer simulations for sound systems. A key feature is a summary of the available loudspeaker data formats used by commercial sound system modeling programs. Many color illustrations showing computer modeling output complements the text.

Chapter 13 by Douglas Sturz summarizes noise control in heating, ventilation, and air conditioning systems. Unlike many publications, the author provides a descriptive narrative of the subject matter with little in the way of equations, nomograms, or tables that can be used for HVAC system noise control design. The chapter describes all the major noise sources and transmission paths and would serve as an excellent introduction to those not familiar with HVAC system noise control or those using commercial noise control software.

The late Ewart "Red" Wetherill's chapter on acoustical design of worship spaces contains much material, nearly two-thirds of it applicable to most building types and not just worship houses. Topics include interior and exterior sound isolation, HVAC noise control, requirements for speech and music, sound systems, sanctuary planning, room acoustics, and information on the construction process and different means of project delivery. Only 10 pages in Chapter 14 are specific to worship house sanctuary and choral room design. One factor I found helpful was a graph showing how reducing the background noise level increases the perceived room reverberance.

The last chapter covers in considerable depth the design of performing arts spaces. Written by the late Ronald L. McKay, David Conant, and K. Anthony Hoover, the chapter is subdivided into

three general areas: music performance spaces, dramatic arts spaces, and music education spaces. Each section is written by one of the authors. The chapter ends with a glossary of technical terms. Part 1 on music performance spaces serves as a compendium on acoustic design for this performance venue type and includes concert, opera, and multi-purpose halls. Little new ground is broken here, but examples of precedent halls and case studies from the author's consulting practice help convey valuable design concepts. Part 2 covers dramatic performance spaces with emphasis on proscenium, thrust stage, and experimental theater forms. General acoustic design and speech intelligibility requirements are outlined before each venue type is examined to include an example case study from the author's consulting practice. Part 3 addresses the different spaces that comprise the music education suite. Covered are design considerations for sound isolation, HVAC system noise, and room acoustics. Different spaces such as classrooms, faculty offices and studios, practice rooms and ensemble rooms, and critical listening and recording studios are described. A criticism of this chapter is that the section numbering is very complex with up to 7 subdivisions to identify sections or paragraphs. A dedicated chapter each for music performance, dramatic arts, and music education spaces would have simplified the numbering scheme.

There are several aspects that would make this book more useful as a reference source. First, there is no index; however, the table of contents is very detailed, which aids in finding a topic. Second, there is no symbols list. Third, symbol usage is not consistent among the different chapters. Lastly, the introductory paragraphs for many chapters are not consistent. Some are titled as Introduction, others use Overview, Abstract, or have no title at all, while some have several introductory paragraphs with different titles before continuing with the body of the chapter. Typographical and editing errors are few, while page 386 in the review copy was misprinted as a blank page without any text.

Overall, even with my criticisms, this book is valuable resource for those with a background in architectural acoustics. The selection of topics represents the latest work and insights in the field and including subjects not covered in other books makes it a useful addition to the acoustics literature. Instructors teaching a class in architectural acoustics will find much supplemental material to complement the customary textbook content.

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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).

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

June 16-19, 2019
INTER-NOISE 2019
2019 International Congress on Noise Control
Madrid, Spain
http://internoise2019.org/

August 25-28, 2019
NOISE-CON 2019
San Diego, CA, USA
http://inceusa.org

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Information on listings in the Directory of Noise Control Services is available from the INCE-USA Business Office, 11130 Sunrise Valley Dr., Suite 350, Reston, VA 20191-4371 Telephone: +1.703.437.4073 e-mail: ibo@inceusa.org.

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Books Available

Noise and Vibration Control, edited by Leo L. Beranek
Noise Control in Buildings, by Cyril M. Harris

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