NOISE/NEWS INTERNATIONAL

Volume 24, Number 4
2016 December

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

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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

Editor's View

I have two issues I want to discus in this column. The first is very personal and the second is about the future of noise control conferences.

I just learned yesterday that my former major professor, Dave Tree from Purdue University, died. His obituary is in this issue. When I decided to go back to school to get my PhD, I looked at a number of schools. Frankly, the time I spent with Dave during my visit to Purdue was a major factor in deciding to go there. Dave spent the better part of a day with my wife and me. He was just as concerned about us finding a good place to live in West Lafayette and possible employment for my wife as he was about showing me the facilities of Herrick Labs. During my time at Purdue, I never felt like I was Dave's student. I was always his colleague. The opportunities he gave me to do things I never thought possible stick with me today. I learned more about life and how to conduct myself in the world from Dave than I did about engineering acoustics. He was a devout member of The Church of Jesus Christ of Latter-day Saints. His humility and faith were something I carry with me today. While I was at Purdue and since, I have often had people ask about my major professor and be disappointed or express regrets that I was not able to work with one of the more famous professors there. I did wonder about that when I first started my graduate studies. However, I soon learned and still believe I was especially lucky. Dave taught by the example of his life and he always put my learning and growth ahead of his reputation. I will miss him greatly.

The other issue I wanted to discuss is the future of conferences. There is a lot of talk about virtual conferences and allowing people to remotely log in to participate in technical sessions at conferences. There are a number of issues around such exercises. Some are concerned that offering the ability to attend conferences virtually will reduce attendance and negatively impact the experience of in-person networking and similar activities at conferences. Establishing a fee structure for virtual attendees is also a concern. Perhaps the more fundamental issue is the impact of the key aspects of technical sessions—the exchange of information. Can the virtual attendee interact with the presenter in a useful way? Asking questions through an Internet link may be difficult or impossible in some situations. One could contact an author by e-mail or other means after the session, but this would not replace the experience of catching the person in the hall or at the end of the session for a talk about some key issue. There are also the issues of not being able to network in the hallway or meet with the vendors in the exhibition. This has to be weighed against the convenience of participating in a session from your home or office.

There are definitely some pros and cons to virtual conference attendance. At a time when many have commented that there are simply too many conferences, virtual sessions are a possibility that needs to be considered. I would very much like to hear from you. What do you think? Would you take advantage of virtual attendance? What would be the positives or negatives for you? I look forward to your feedback.

Jim Thompson, PhD, PE, INCE Bd. Cert
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Obituary

David Rees Tree passed away in West Jordan, Utah, on September 29, 2016. He was 80 years old. He was born to Ira Tree and Mae (Rees) Winters on July 18, 1936, in Wanship, Utah. David was just 8 years old when his father died in WW II. He was the youngest of 4 children.

David fulfilled a mission for The Church of Jesus Christ of Latter-day Saints to the North Central States Mission. He taught and saw only two people baptized. One was a 9-year-old boy. That boy, with the help of many priesthood leaders, stayed faithful to the church and later became the Mission president to David's grandson Ben.

David married his high school sweetheart, Roberta, in the Salt Lake City Temple on October 31, 1958, shortly after returning from his mission. They spent most of their 57 anniversaries handing out Halloween candy.

David graduated from Brigham Young University with a BS and MS in Mechanical Engineering. He then attended Purdue University, where he earned a PhD and was offered a position as a faculty member. Professor Tree's research involved improvements in air conditioning and refrigeration as well as acoustics. At Purdue, he taught many different mechanical engineering courses, advised graduate students, served as an associate chair, worked in the contracts office, and organized meetings for ASHRAE. Most of his research was done in the Herrick Laboratories at Purdue. He remained in West Lafayette for 45 years.

In 1970, David was given the opportunity to take a sabbatical leave from Purdue. David, Roberta, and their 5 young children moved to South Hampton, England. David earned a post doctorate at the University. He served at church as a counselor in the district presidency while living there. While in England, the family traveled all over seeing the sights. During the last few weeks of the sabbatical, they traveled all across Europe in a little camper trailer being pulled by their car.

David loved BYU! Many a day he roused his children from bed by singing "Rise and shout, the Cougars are out!" He watched BYU football on TV at home and would often talk about his days there and want to hear about the goings-on of the grandchildren and his son on the campus. On the last weekend of his life, he wanted to hear about the BYU football game.

David had strong opinions, a feisty temperament, a passion for teaching, and a love for people. He loved to get to know people, to ask them questions, and to follow their lives. He would often stop at a restaurant or any other public place to talk to a complete stranger. He was honest in his expression of belief and opinion. He was a man of integrity. He would tell you if he did not want to do something, but if he said he would do it, it would be done.

After retiring, David and Roberta sold their home in Indiana and moved to West Jordan, Utah, to be close to family. They received a warm welcome there and made many new friends. Although they did not look back but forward, they clearly considered Indiana and their friends there to be a second family and their home.

David was a faithful member of The Church of Jesus Christ of Latter-day Saints. He served in numerous church assignments right up until his death. He served in Cub Scouts, Young Men's, Elders', and High Priests. He was Bishop of the Purdue Ward twice. He served 8 years as a Counselor in the Stake Presidency of the Indianapolis North Stake and multiple times on the high Council.

David was preceded in death by his father, mother, and sister Noreen (Keith) Turnbow. He left behind his wife, Roberta; sons, Alan (Rae) Tree, Dale (Karen) Tree; daughters, Robbi (Mark) Pixton, Becky (Mike) Pickard, Jane (Aaron) Walton; 21 grandchildren; 18 great-grandchildren; sister, Stella (Stan) Welsh; brother, Ira (Janice) Tree. We will all miss David and know that we will be reunited with him.

Place of Birth: Wanship, Utah
Place of Death: West Jordan, Utah
Hobbies: He loved BYU; gardening; loved cookies and chocolate chips; camping
Occupation: College Professor/Mechanical Engineering

David Rees Tree
Jul 18, 1936–Sep 29, 2016

ProAcústica Member Society

Brazilian Association for Acoustical Quality (ProAcústica)—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 acoustic 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.

Our strategic guidelines aim at a greater interaction and continuous alignment with our members; the consolidation in the civil construction and acoustic markets; the ongoing establishment of action plans, support programs, and promotion of selected content to different audiences; and the consolidation of sector-based partnerships with other organizations, governments, and society.

The **mission** of the association is to promote and spread the importance of good techniques and acoustic quality in buildings and in the environment as a factor of well-being and health for society. The **vision** is to transform our entity into a benchmark and be proactive in defining and announcing best practices in acoustic solutions.

The membership categories are **founders, effectives,** and **benefactors**. *Effectives* are companies or professionals characterized by: construction companies and builders, installation and distribution companies, manufacturers of acoustic products, engineering and architecture firms, laboratories, liberal professionals (individual member), and acoustic consultants and designers.

A | Affiliates

Currently **63 companies** are members:

- **34 manufacturers of acoustic products**—54%
- **19 acoustic project and consulting firms**—30%
- **7 installation and distribution companies**—11%
- **3 laboratories**—5%

To see more information, click here.

B | Biennium 2016–2017—Officers and Board of Directors

- 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
- Gilberto Fuchs de Jesus (Grom)—Chairman of the Board
- Nicolas Jean Edouard Isnard (01dB Acoem Brasil)—Vice Chairman of the Board
- Cândida de Almeida Maciel (Síntese Arquitetura)—Adviser
- Olavo Fonseca Filho (Grupo Sonar)—Adviser
- Rafael Schmitt (Scala DB)- Adviser
- Rafael Siais Furtado (Isar)—Adviser
- Edvaldo Ribeiro (Junseal)—Adviser
- Marcelo de Godoy (Modal Acústica)—Adviser

To see more information, click here.

C | Technical Committees

These committees aim to promote discussion about environmental and habitability issues, and collaboration in the development of laws, technical standards, and especially the review and adaptation of Building Performance Standard (ABNT NBR15575) and of Acoustics Standard (ABNT NBR 10151 and NBR 10152). They are also responsible for the publication of technical manuals, formatting courses, lectures, content production, and other activities.

Environmental Acoustics

- Coordinator: Marcos Holtz
- Technical publication: Manual of Acoustic Classification in an Urban Area (*under development*)

Acoustics in Buildings

- Coordinator: Juan Frias Pierrard
- Technical publication: Manual of Performance Standard for Buildings

Floating Subfloors

- Coordinator: Rafael Schmitt
- Technical publication: Manual of Basic Recommendations for Subfloors Floating

D | Ethics Committee

This committee was being set up, as well as the preparation of the "Compliance Manual" release in February 2016.

The focus of this "Compliance Manual" is to integrate the activities with good corporate

governance practices in order to promote policies aimed at providing a minimum standard for all members of ProAcústica, and is designed to prevent unfair trade practices.

To see more information, click here.

E | Conferences 2016/2015/2014

Organize annually the City Council Conference on Noise, Vibration, and Sound Disturbance with over 300 participants.

- **About 2016**: http://www.conferenciaruidosp.com.br/
- **About 2015**: http://www.conferenciaruidosp.com.br/2015/index.html
- **About 2014**: http://www.conferenciaruidosp.com.br/2014/index.html

Urban Noise Mapping

As one of the results of the City Council Conference has being approved, the law that will force the publication of the Urban Noise Mapping to set targets and timetables for reducing noise in the city. Law 16.499/2016 (from July 21, 2016).

To see more information, click here.

F | Specialization Courses and Update

- Course acoustics for beginners: specifiers and sales representatives
  To see more information, click here.
- Course acoustic performance of residential building
  To see more information, click here.

G | Acoustics for Schools—Documentary Video

The documentary 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.

To see more information, click here.

H | Communication Tools

ProAcústica Portal: www.proacustica.org.br

The website that brings together all industry information; the association's activities, affiliates, technical publications, articles, events, courses, cases, etc.

ProAcústica News: www.proacustica.org.br/noticias/newsletters-com-as-novidades-da-area-de-acustica.html

A newsletter published quarterly to the association's mailing includes more than 19,000 records in addition to outsourced mailing

ProAcústica Social Networks

LinkedIn: https://www.linkedin.com/in/associa%C3%A7%C3%A3o-proac%C3%BAstica-a3a0b548

Facebook: https://www.facebook.com/AssociacaoProAcustica/

Twitter: https://twitter.com/Pro_Acustica

Youtube: https://www.youtube.com/channel/UCFLuSEVlWegRB2dXiWEod0w

Edison Claro de Moraes, **President**

Eng. Davi Akkerman, **Vice President of Technical Activities**

INTER-NOISE 2016 Report

INTER-NOISE 2016, the 45th International Congress and Exposition on Noise Control Engineering, was held on August 21–24, 2016, at the Congress Center Hamburg (CCH) in Hamburg, Germany. Seven hundred and ninety-three (793) technical presentations were given at the conference. There were eight hundred and nineteen (819) papers distributed to conference attendees of the proceedings on a thumb drive. This conference was organized by Deutsche Gesellschaft fur Akustik (DEGA). Otto von Estorff and Brigitte Schulte-Fortkamp served as the conference presidents, with Wolfgang Kropp serving as the technical program chair. Teresa Lehmann and Florian Hoffmann were the exhibition managers. Klaus Genuit served as the conference treasurer. The proceedings editor was Wolfgang Kropp.

The contributors to this conference came from around the world. There were 60 regions represented with large contributions from Germany, Japan, and Korea. There were 6 peer-assessed papers presented at the conference and 888 total papers presented. In addition, there were 95 poster papers presented. The major session topics are shown in Table 1.

Table 1. Major Session Topics

Active Control	Noise Barriers
Advanced Measurement Techniques	Numerical Acoustics
Aeroacoustics	Product Sound Quality
Aircraft Interior Noise	Psychoacoustics
Aircraft Noise, Exterior	Sound Power
Auralisation	Sound Propagation Outdoors
Building Acoustics	Soundscape
Dynamap	Train (Noise and Vibration)
Education	Tyre/Road Noise
Environmental Noise Directive	Underwater Acoustics and Ship Noise
Green Noise Control Measures	Urban Sound Planning
Industrial Noise	Vehicle Acoustic
Machinery Noise	Vibroacoustics
Materials	Wind Turbines
Noise and Health	

There were a large number of short courses offered in conjunction with the conference. These are summarized in Table 2.

There were also several satellite sessions held in conjunction with this conference. A series of sessions were offered in Berlin on the Thursday and Friday following the conference. There was also a Buy Quiet symposium on Thursday at the conference center in Hamburg. These are shown in Table 3.

Table 2. Short Courses and Seminars Offered at INTER-NOISE 2016

Course	Organization
Course A: A General Framework for Structural Investigations	Dr.-Ing. Dejan Arsić and Dr. Dennis de Klerk
Course B: Evaluation and Assessment of Industrial Noise	Antonio Notario Tévar
Course C: Methods and Tools for Sound Design—Applications of Psychoacoustics	Dr. André Fiebig and Dr. Roland Sottek
Course D: Noise Control and Hearing Protector	Samir N. Y. Gerges
Course E: Real 3D Beamforming and Correlation Analysis	Benjamin Vonrhein and Michael Kerscher
Course F: Sound Source Localization Methods Based on Particle Velocity	Marcin Korbasiewicz

There was an excellent accompanying person program with a tour arranged each morning of the conference and information on a large number of other tours and sightseeing opportunities. The conference registration is summarized in Table 4.

There were registrants from approximately 60 different countries.

Opening the Conference

The opening events for the conference were held on Sunday afternoon, August 21.

Photo 1. Conference Opening Entertainment—Frollein Sax

Table 3. Satellite Sessions

Session	Organizers/Chairs	Location
Buy Quiet	Marco Beltman, Robert Hellweg, Jean Jacques, Patrick Kurtz, and Jean Tourret	Hamburg
Building Acoustics—Towards a Better Understanding	Heinz-Martin Fischer, Martin Schneider, Berndt Zeitler	Berlin
European Noise Policy	Regina Heinecke-Schmitt, Bernd Lehming	Berlin
Soundscape and Psychoacoustics—Using the Resources for Environmental Noise Protection	André Fiebig, Klaus Genuit, Brigitte Schulte-Fortkamp	Berlin

Table 4. Conference Registration

Category	Number
Registrants	1330
Young Professionals	16
Accompany Persons	43
Number of Exhibitors	54
Exhibitor Staff	120
No-shows	9 + 18 cancellations

Entertainment was provided by Frollein Sax, a quartet of saxophone players (see Photo 1). The conference was opened by the cochairs Otto von Estorff and Brigitte Schulte-Fortkamp (see Photos 2 and 3). This was followed by brief presentations by the state minister for the environment, Jens Kerstan (see Photo 4). He made a very strong case for the importance of noise as an environmental issue. This presentation was followed by a welcome by Jesko Verhey, the vice president of the German Acoustical Society (DEGA) (see Photo 5). Joachim Scheuren, the president of the International Institute of Noise Control Engineering (I-INCE) added his welcome (see Photo 6). He discussed the importance of this conference, which is the last he would preside over as president as his term comes to a close. These opening ceremonies were followed by the first plenary session, "The Noise in Our Head," a very interesting presentation made by Sieglinde Geisel (see Photo 7). Ms. Geisel is a Swiss journalist and the author of a book on this same topic. Her book is *Only in the Universe, It Is Really Silent from Noise and the Longing for Silence*. It is published by Galiani Berlin and the ISBN is 978-3-86971-015-0. Her talk focused on how noise is perceived, with an interesting historical perspective on noise and the words used to describe it. She noted that, considering the tumultuous history of the anti-noise associations and the anti-noise laws, the paradox is that the world is getting louder and more and more

Photo 2. Otto von Estorff at Opening Ceremony

Photo 3. Brigitte Schulte-Fortkamp at Opening Ceremony

Photo 4. State Minister for the Environment, Jens Kerstan

Photo 5. Jesko Verhey, the Vice President of the German Acoustical Society

Photo 6. Joachim Scheuren, the President of the I-INCE Welcoming all to Conference

Photo 7. Sieglinde Geisel Giving Opening Plenary Lecture

people are fleeing the cities for silence. From history we know: Schopenhauer, Proust, and Kafka complained about noise, Carlyle built a soundproof study, and Kant ended up putting a too-loud rooster in the stockpot. But of course, nothing is more personal than the sound sensation.

This plenary session was followed by the opening ceremony for the conference. This was a very nice opening reception with a warm welcome to attendees from around the world.

Monday, August 22

The technical program began on Monday, August 22. There were 15 parallel sessions covering a wide array of topics. There were two keynote lectures at 11:00 a.m. and 11:30 a.m. At 11:00 a.m., Stephen Rizzi presented a lecture called "Toward Reduced Aircraft Community Noise Impact via a Perception-Influenced Design Approach" (see Photo 8). In this talk Dr. Rizzi noted that new aircraft designs are radically different and produce different noise signatures. He noted that the perception of sound is critical in understanding how people will react to the noise from these new designs and in regulating their noise emissions. He demonstrated the tools developed and validations conducted by NASA to be able to understand reaction to the potentially new sound characteristics. The connection between aircraft design and sound characteristics was well demonstrated in this lecture.

Photo 8. Stephen Rizzi Presenting Keynote Lecture

Photo 9. Thomas Beckenbauer Presenting Keynote Lecture

The second keynote lecture was by Thomas Beckenbauer and was titled "Tire/Road Noise Mitigation: A Challenge for Both Acoustical and Civil Engineers" (see Photo 9). Dr. Beckenbauer noted that even electric cars, which have eliminated many automotive noise sources, still run on roads with pneumatic tires. He indicated that much has been done to demonstrate that there are means to design quieter tires and roads. However, there are significant challenges to implementing and maintaining these quieter designs. His focus was on low-noise road surfaces and the progress that has been made. He presented a detailed discussion of such road surface, their construction, and considerations as to their performance over time.

There was a full slate of technical sessions on Monday covering a wide range of topics. The exhibition also opened on Monday. With 60 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.

An important event on Monday, August 22 was the special session honoring Manfred Heckl—a pioneer in engineering acoustics. This session, chaired by Joachim Scheuren, Werner Scholl, and Wolfgang Kropp, was an excellent tribute to this early visionary. There were presentations from many who worked with him honoring both his technical achievements and his life as a leader in the field.

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 Photos 10 and 11 and Table 5). There was a reception afterward providing a chance for one-on-one interactions between the young professionals and I-INCE officers and board members. 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, 120 grants (out of 247) were awarded between 2010 and 2016, as shown in Table 6. For INTER-NOISE 2016, I-INCE had allocated 16 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

Photo 10. Raj Singh Opening Young Professionals Workshop

Photo 11. Young Professionals Workshop

Table 5. 2016 Young Professionals Grant (I-INCE) Winners

Name	Status	Country
Simon Brown	Student	United Kingdom
Susumu Hirakawa	Student	Japan/United Kingdom
Paramasivam Balakrishnan	Student	India
Gil Jun Lee	Student	Republic of Korea/USA
Shahab Fatima	YP (Post-doc)	India
Marko Janković	Student	Serbia
Joshua Meggitt	Student	United Kingdom
Alexander Lee	YP	Republic of Korea/Germany/Switzerland
Yuanfang Zhang	Student	China/France
Chang Liu	Student	China/The Netherlands
Behshad Noori	Student	Iran/Spain
Miodrag Stanojević	Student	Serbia
Ana Đorđević	Student	Serbia
Daniel Steele	Student	USA/Canada
Dongwoo Min	Student	Republic of Korea
Gahee Kwon	Student	Republic of Korea

workshop to 88,500 EUR for a period of nine years (2010–2018). As of this writing, 38 countries have been represented. More details about the demographic spread, as well as the announcement for the INTER-NOISE 2017 grant competition (to be posted soon), can be found here.

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 (often very good) are rigorously reviewed by the I-INCE panel. A provisional winners list is compiled and given to the technical program chair and 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.

Photo 12. Siv Leth Presenting Keynote Lecture

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 2016 included some returning favorites like "How to Network?" and "How to Publish a Paper on Noise?" This year, the young professionals were also given the "Perspective of a Young Professional" by previous grant recipient Dr. O. T. Sen, Istanbul Technical University (Turkey). More information is given here.

Tuesday, August 23

Again on Tuesday there were 15 parallel technical sessions in operation covering a wide range of topics. The two keynote lectures were at 11:00 a.m. and 11:30 a.m. The first keynote was by Siv Leth (see Photo 12). The title of her presentation was "Silent Electric Train Transportation—Present and Future Technologies." This presentation provided a thorough discussion of noise control projects to

reduce primarily electric train noise. The programs conducted, both experimental and analytical, were described and the reductions accomplished were described. The lecturer noted that the difference between electric cars connected as a train and electrical multiple units forming trains are diminishing, and hence also the research question will have to evolve for noise control of new electric rolling stock as well as new all electric vehicles.

The second keynote lecture was by Christ de Jong. The topic was "Underwater Radiated Noise of Ships: Measurement and Mitigation" (see Photo 13). The various noise sources of underwater noise from ships were discussed by this author. He noted that there is a wide range in radiated noise with many military ships being relatively quiet and older commercial ships being the noisiest. A procedure for the dedicated pass-by tests, in which the ship cooperates to have its radiated noise measured at various speeds and settings, was described as a first international standard for surface ship radiated noise measurements (ISO 17208-1). There is still a great deal of effort to understand the uncertainty in ship pass-by measurements.

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

Table 6. Distribution of YP Grant Winners Since 2010

Country	Country of Origin	Country of Work/Study
Albania	1	0
Argentina	2	2
Australia	1	2
Austria	2	3
Belgium	4	4
Brazil	2	2
Canada	0	1
Chile	1	0
China	20	5
Czech Republic	1	0
Denmark	0	2
France	4	4
Germany	11	10
Hong Kong	0	1
Hungary	2	2
India	7	3
Indonesia	2	2
Iran	2	0
Italy	5	6
Japan	4	6
Korea	11	8
Malaysia	0	1
Netherlands	5	3
New Zealand	1	2
Pakistan	1	0
Poland	1	1
Russia	1	1
Serbia	4	4
Singapore	0	1
Spain	4	4
Sri Lanka	1	0
Sweden	1	4
Switzerland	1	2
Turkey	4	4
United Kingdom	4	13
USA	7	18
Vietnam	2	0
Zimbabwe	1	0

Photo 13. Christ de Jong Presenting Keynote Lecture

Photo 14. Marc Schönwiesner Presenting Closing Plenary Lecture

Wednesday, August 24

There was a full slate of technical sessions until 2:00 p.m. on Wednesday.

Photo 15. Award to Tor Kihlman

Photo 16. INTER-NOISE 2016 Volunteers and Staff

The final plenary lecture was presented by Marc Schönwiesner and was titled "Tuning the Brain for Sound: Solvable Problems in Auditory Neuroscience" (see Photo 14). This was a very interesting talk that was about neuroscience related to hearing as well as other topics. The presenter provided several interesting examples where equipment was used to modify hearing localization of subjects to study the effects. These studies showed that most subjects adjusted quickly, and most surprisingly, adjusted almost immediately when the modification was removed. The presenter also demonstrated how sounds and even visual images can be recreated from neural signals to interpret dreams and perhaps one day better understand hearing. While clearly not about noise control, this was an interesting and thought-provoking introduction to understanding the brain and its role in hearing and other forms of perception.

This plenary lecture was followed by the closing ceremonies. An important event during this session was the presentation of an award honoring the contributions of Tor Kihlman to I-INCE and the profession of noise control engineering (see Photo 15). This award was present by Joachim Scheuren, the president of I-INCE. More information about this award is provided in a separate feature.

Following this award, Otto von Estorff and Brigitte Schulte-Fortkamp, the conference cochairs, thanked all those who had participated in organizing and running the conference. They brought up all the student volunteers on stage for recognition of the outstanding work they had done (see Photo 16). They also recognized the entire organizational team.

The final presentations were brief announcements about the upcoming conferences: NOISE-CON 2017 in Grand Rapids, MI, USA, and INTER-NOISE 2018 in Chicago, IL, USA. At the final presentation, the organizers of INTER-NOISE 2017 invited everyone to come to Hong Kong August 27–30, 2017 (http://www.internoise2017.org/index.php).

I-INCE Young Professional Congress Attendance Grants for INTER-NOISE 2017

I-INCE has allocated funds to support 20 YP grants, each having a value of 600 EUR, to assist students and young professionals/engineers in attending the Congress. More details of the YP program can be found here: http://i-ince.org/youngprofessionals.php

Leo Beranek

Passing of Leo Beranek

I just learned of the passing of Leo Beranek. This was a real shock. Leo has been a fixture in the fields of acoustics and noise control for my entire career. When I was a co-op student and was told by my boss I would be the office noise expert, one of the books tossed on my desk to study was by Leo Beranek. Later, the textbook for the first course I took in noise control was edited by Leo Beranek.

Years later, I was at an Institute of Noise Control Engineering of the USA (INCE-USA) planning meeting and, during lunch, I sat down by chance at the table directly across from Leo Beranek. To be honest, I was not sure he was still alive having seen the copyright dates on some of his early publications. Before long, he had the whole table enthralled with his stories about his adventures and his enthusiasm for acoustics. To learn more about Leo, see his recent autobiography and the obituary that follows.

Without equivocation, Leo was a founder of the field of noise control. He was a leader in forming INCE-USA and initiated the thoughts for the publications and conferences we have today. I am not going to claim to be a great friend of Leo's. I knew him well enough to say hello and talk occasionally about noise control and INCE-USA. I do not have sports or entertainment heroes. There are historical figures that I admire, but until yesterday, I had only one living hero. That was Leo Beranek. His contributions to the field of noise control are numerous, including societies, books, papers, concert halls, and most of all, recognition. He made noise control a real engineering discipline. I know I could never do what he had done, but I always had someone to try to emulate.

With all his accomplishments, considerable wealth, presidential awards, etc., you might think Leo would be a little aloof and hard to approach. In fact, the opposite was true. He was always enthusiastic about acoustics and would talk about the issues and what needed to be done with anyone who would listen. I think he sometimes got frustrated with the lack of progress on some topics, but he was very approachable and he motivated others with his enthusiasm.

To say he will be missed is an understatement. His passing is a great loss to the noise control community in the United States and around the world. He was truly a pioneer with outstanding courage, vision, and enthusiasm. He will be remembered fondly for all he contributed and accomplished. Personally, I will never forget his enthusiasm and passion for acoustics that continued beyond his first century of life and to his last days with us. I will always remember seeing him at a conference when he was 101, running to catch a speaker with a smile on his face. We all should enjoy our life's work so much.

Jim Thompson
NNI Managing Editor
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Leo Beranek Obituary

Leo Beranek, a Massachusetts renaissance man—scientist, teacher, entrepreneur, television executive, philanthropist, author—died in Westwood, Massachusetts, on October 10, 2016, at age 102 after a long and extraordinarily productive life. He leaves his wife Gabriella; sons James K. Beranek of Cedar Rapids, Iowa, and Thomas B. Haynes of Chicago, Illinois; and granddaughter, Antonia Hsu Haynes. He was predeceased by Phyllis Knight Beranek, his wife of 42 years.

A 1936 graduate of Cornell College (Iowa) with a BA degree in physics and mathematics, Beranek went on to graduate school in the Applied Physics Department of Harvard University where he received his DSc degree in 1940 in the field of acoustics.

Beranek stayed at Harvard during World War II as director of two laboratories, the first being the Electro-Acoustic Laboratory, which dealt with voice communication in combat vehicles, and then the Systems Research Laboratory, whose mission was to improve the US Navy's ability to combat Japanese Kamikaze aircraft attacks. At the war's end, President Harry S. Truman issued Beranek a *Certificate of Merit* for his contributions to the war effort.

After World War II, Beranek became associate professor of communication engineering at the Massachusetts Institute of Technology where he taught courses in electrical engineering and acoustics. His seminal textbook, *Acoustics*, was published in 1956, forever changing the teaching of acoustics to engineers.

In 1948, the acoustical consulting firm Bolt, Beranek and Newman (BBN) was formed with Beranek as president. Its first projects were the acoustics and sound systems in the United Nations buildings in New York, followed by NASA's jet engine test facility in Cleveland. NASA's first test of a new supersonic jet engine created such a loud noise for miles around that the city of Cleveland shut it down. Successfully solving the problem, Beranek designed and saw built the world's largest acoustic muffler, which was featured in *LIFE* magazine (6/11/51).

In the fall of 1958, BBN began work for the Port of New York Authority (PNYA), which operated the Idlewild

Airport (now JFK) serving New York City. Pan American Airlines had requested permission to fly the Boeing 707 (the first passenger jet airplane) from JFK, but the PNYA said that the plane must not produce more noise in the neighborhoods around the airport than that produced by existing propeller aircraft. Beranek and his team determined that the Boeing 707 was so noisy that its engines had to be equipped with heavy mufflers and follow a prescribed takeoff procedure in order to meet the PNYA's dictum.

In 1965, under Beranek's leadership, BBN became the vanguard of the digital age by putting together one of the best computer software groups in the East. In 1968, the Advanced Research Project Agency (ARPA) awarded BBN a contract to build a network to hook together 19 large-scale computers of different makes and different program languages, and in different locations. To do this, BBN invented the ARPANET, which consisted of 19 "Interface Message Processors" (IMPs), each of which was associated with one of the 19 mainframe computers. In the network, signals traveled from one IMP to another, and each IMP acted as the interpreter of messages that went to and from its associated mainframe computer. The first message between two IMPs and their associated computers was sent in September 1969. In 1971, BBN invented email with "@" as we know it today. The ARPANET grew, and when it reached about 500 users, it was split in two and rejoined by the TCP/IP protocol. This occurred on January 1, 1983, and that is the official birthdate of the INTERNET. Other networks soon joined and today people around the world enjoy the fruits of this invention.

Beranek left BBN in 1969 to become president of Boston Broadcasters Inc., which, after a long court battle, took over operation of Channel 5-TV in 1972 using the call letters WCVB. The programming at WCVB was so improved that the *New York Times* in 1981 carried a full-page article headed "Some Say This Is America's Best TV Station." The station was later sold to Metromedia.

After his foray into broadcasting, Beranek returned to acoustics. Among others, he consulted on five concert halls and an opera house in Japan. Among them was the Tokyo Opera City Concert Hall, which was hailed as an "acoustical miracle" on the front page of the *New York Times* (4/18/2000). The Hall, which opened in September 1997, is now considered one of the five best concert halls acoustically in the world.

PUBLICATIONS: Beranek published 185 technical papers and 13 books, the last 4 of which are: *Concert Halls and Opera Houses* (Springer 2004); *Noise and Vibration Control Engineering* (with coauthor; Wiley 2006), *Riding the Waves* (autobiography; MIT Press 2010), and *Acoustics: Sound Fields and Transduxers* (with coauthor; Elsevier 2014).

PUBLIC SERVICE: Beranek served the Boston Symphony Orchestra as a member and chairman of the Board of Overseers and later as member and chairman of the Board of Trustees (1968–1988). He was full-time president of the American Academy of Arts and Sciences for five years. The alumni of Harvard University voted him a member of their senior governing body, the Board of Overseers, for six years. He also served as president of the Acoustical Society of America and the Audio Engineering Society.

Both the Museum of Fine Arts Boston and the Boston Symphony Orchestra list Beranek and his wife as major financial benefactors.

HONORS: Member, National Academy of Engineering; Fellow, American Academy of Arts and Sciences; Fellow, American Physical Society; Honorary Member, American Institute of Architects; Fellow, Institute of IEEE.

AWARDS: 2003 National Medal of Science (Presented by President George W. Bush); IEEE Founders Medal; Gold Medals from the Acoustical Society of America, Audio Engineering Society, and American Society of Mechanical Engineers; Lifetime Achievement Award from the International Commission on Acoustics; and the Abe Lincoln TV Award (Top USA Award for TV Management) from the Radio and TV Commission.

HONORARY DOCTORATES: Worcester Polytechnic Institute; Northeastern University; Suffolk University; Cornell College (Iowa); Emerson College.

Tor Kihlman

Honoring Tor Kihlman at the Closing Ceremony of INTER-NOISE 2016 on August 24, 2016, in Hamburg, Germany

Ladies and Gentlemen, dear colleagues, dear Tor Kihlman,

I am more than happy, I am proud to start this closing session by introducing and honoring one of the fathers of continuity of our institute, Tor Kihlman. I-INCE, the International Institute of Noise Control Engineering, does not have any awards, medals, or whatever predefined expressions of recognition or esteem. But of course we feel free to occasionally express such respect and acknowledgement or, in the case of Tor Kihlman, I should rather say, we even feel under obligation to do so and you will soon know why.

Tor Kihlman was born where he still lives, in Göteborg, Sweden. He stayed there for his academic education at Göteborg's Technical University, and he further stayed for starting his professional career as a research assistant at Chalmers University of Technology from 1957 to 1966. However, this does not mean at all that he stayed there forever. No, in 1966 he left for three years and went to the Institute of Technology in Lund, Sweden, as Associate Professor in Building Acoustics.

But then, in 1969, he was appointed the real professor as we all know him for 47 years, the Professor in Building Acoustics at Chalmers University of Technology in his city, the city of Göteborg. This appointment was linked to the foundation of a new institute, his institute then, and this foundation had been pushed forward by the need for improved sound quality after a huge building program had been started in Sweden.

It is interesting to see to what extent the revival of acoustics, the turn from a rather physical to an indispensable engineering discipline has been initiated by the crisis of cheap and fast after-war construction and reconstruction. This crisis had to discover soon that simplified construction concepts all the more needed explicit, competent inclusion of acoustic aspects. And this was the spirit of the time then, the time of upcoming and emerging engineering acoustics, where noise control succeeded in finding the temporary interest of politics and administration even.

In my country, in Germany, this was to be seen by regulatory initiatives following the guidelines of professional engineering organizations like the Association of German Engineers, VDI. In the US, this political spirit was driving new national noise control initiatives by the federal government of the USA, thus picking up and contributing to the so-called environmental decade. And in Sweden, it was the time to second a huge building project by a supporting research initiative.

This was the time then to found, starting from the US, INCE and I-INCE in support of the identity, the recognition, and the work of noise control engineers. And I really can imagine, Tor, how your unmistakable sense of political opportunities made you turn this spirit into another institutional initiative at Chalmers, thus essentially contributing to the long-term development of acoustics by

establishing and promoting engineering acoustics!

So, although not personally involved yet, you were a companion in spirit of I-INCE from the very beginning and it thus did not take long to make you a companion in action too.

But first, Tor developed his institute at Chalmers and thus made it develop itself a well-known brand, a celebrity in building acoustics, which—due to the long term of 30 active years—gained highest authority among experts and laypersons as well. The positive aura attracted many qualified students and thus set the basis for high technical competence and outreach.

Tor Kihlman's university career made him dean, then vice president of Chalmers University and later vice president of the university's board even. And although I lack reliable respective data, I guess

you frequently used the platform of upcoming INTER-NOISE congresses, and consequently applied for running your own INTER-NOISE in Göteborg. This was to happen in 1990, then and it happened with great success and made you shine with vigor and creative energy at the height of your power. And made you join the I-INCE board of directors to serve the institute—except for one year—continuously as a board member since then.

The photos given here show you in the role of addressing the delegates of INTER-NOISE 1990 at an event in Göteborg's concert hall and at a reception in the exhibition hall. They also show you chatting with Manfred Heckl, your colleague in spirit and intention at the Technical University of Berlin then, who died 20 years ago and therefore has been reminded at this year's conference in a memorial session two days ago.

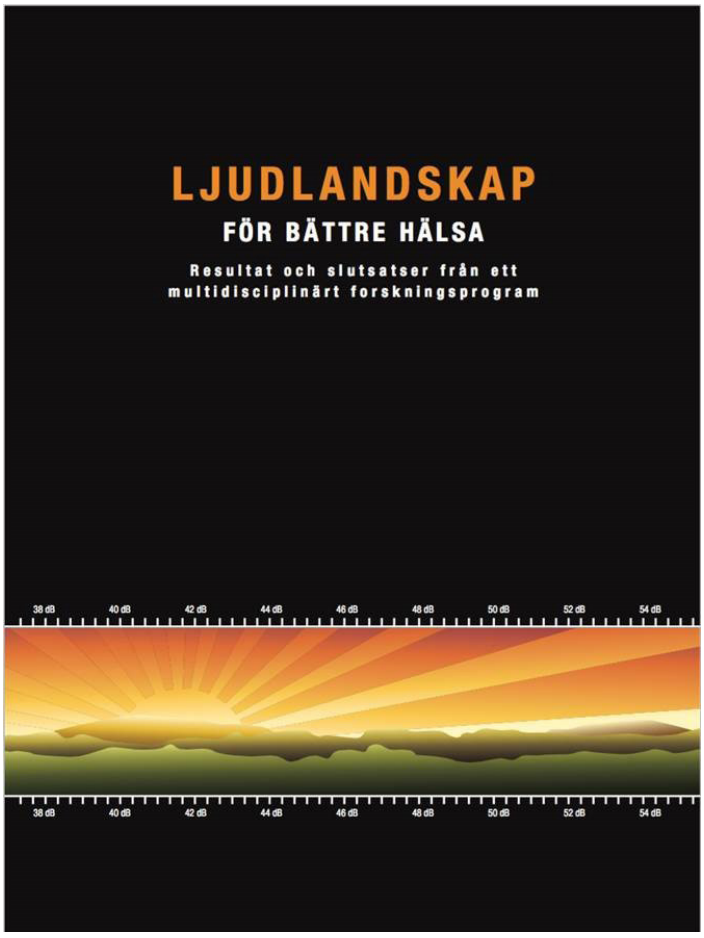
After ten years of director service, Tor Kihlman became the third president of I-INCE from 2000 to 2003, and later a vice president for international relations and global noise policy. This made him act in his second domain of particular talent and aptitude, the political domain, which he was really able to exploit for the interest of acoustics, noise control, and—thereby—I-INCE. Being grown up in a family of political involvement, he naturally found to political and party political activity. And he couldn't help but apply his respective talents to the benefit of his matter, acoustics, and his institutes at Chalmers and I-INCE.

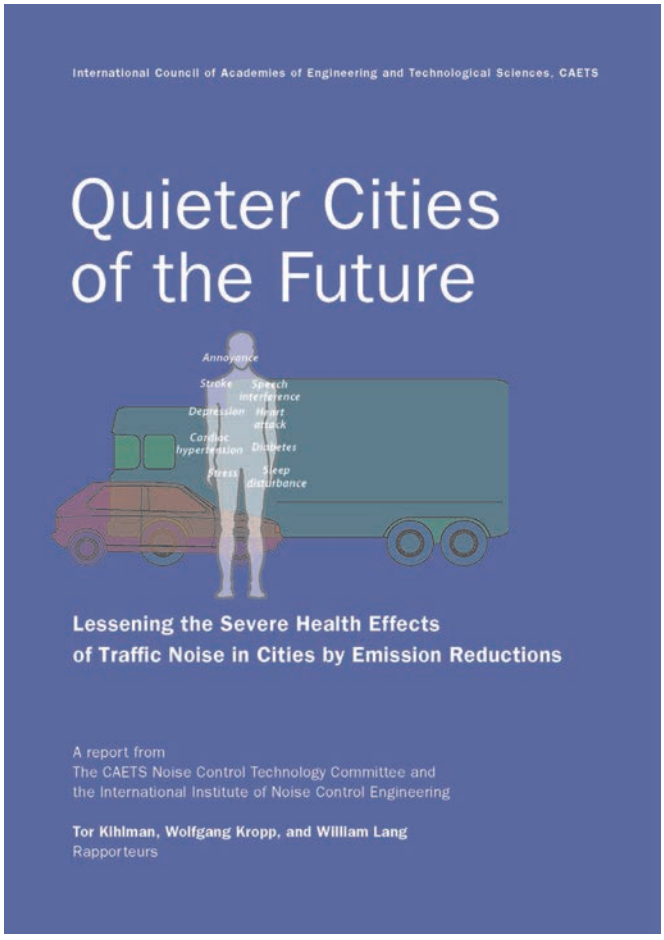
Apart from serving in university committees, he has strongly pushed forward and took a lead in integrating socio- and sociopolitical aspects into the education of engineers. This was, at that time, a really pioneering concept.

For I-INCE this was a kind of second initial impulse, which turned all accumulated energy and self-consciousness of the institute to increasing external visibility and influence. This gave I-INCE effective links to the European Union as well as to other influential institutions like CAETS, the International **C**ouncil of **A**cademies of **E**ngineering and **T**echnical **S**ciences. And this made I-INCE reach many prestigious scientific academies around the world. Tor Kihlman was able to activate these links and make them work to increase the influence and the reputation of noise control engineering and respective associations, in particular I-INCE.

To what extent he succeeded in applying this ability may be seen from the way how he organized his succession at Chalmers. While most universities complicate this process such that it ends up with a significant temporal vacancy, Tor achieved to appoint and employ his successor, Wolfgang Kropp, our technical program chair at this conference here in Hamburg, in advance and thus in parallel.

Tor Kihlman also had great internal influence in I-INCE. He pushed forward the mechanism of regular rotation of mandates, thus insuring personal fluctuation of board members to open up the board for new members and to introduce innovation and alternating experience and networks. He also took guidance in establishing a





consensus-driven culture of discussion and decision. And he supported the transition of the I-INCE board of directors from primarily being a group of previously held INTER-NOISE congress chairs to a team of task-related vice-presidents to further promote the affairs of the institute.

Being an emeritus since 1999, he did not retire from following up his technical and—above all—social and political concerns. He kept his office, went on leading projects, for instance, within the MISTRA-program "soundscape support to health" and worked as chairman of the CAETS Noise Control Technology Committee.

MISTRA was a huge interdisciplinary Swedish project running over eight years, involving behaviour science, environmental medicine, and acoustics, and providing the scientific background for the "quiet site" concept.

Apart from the highly reputable MISTRA report, I would like to mention—among his many involvements and projects—the latest example of his highly qualified and respected reports, which reflects the outcome of a one-day I-INCE symposium held in Innsbruck in September 2013: "Quieter Cities of the Future—Lessening the Severe Health Effects of Traffic Noise in Cities by Emission Reductions."

Finally, we should mention that his volunteering included many other institutions besides I-INCE. He became a member of the Royal Society of Arts and Sciences in Göteborg and a member of the Royal Swedish Academy of Engineering Sciences. Tor also served for ten years in the ICA, the International Commission on Acoustics, including four years as chairman. He also was chairman of the Swedish Acoustic Society and he served in quite a few working groups and committees of Swedish and European politics and administration.

Among his private activities, his passion for sailing should be mentioned. We, your colleagues at I-INCE, always enjoyed hearing about the sailing expeditions of the Kihlmans, which were always fit around our summertime INTER-NOISE meetings.

I am really proud to have the chance of recalling the many merits of one of my predecessors here, who—by the way—also is the source of another, completely different proudness because—as an

adjunct professor at Chalmers—I had reached the level of being an immediate colleague of him at the Chalmers Institute.

In continuation to the honoring given to Bill Lang and George Maling last year at INTER-NOISE 2015 in San Francisco, I-INCE is proud to continue this this year here in Hamburg again by honoring you! After all I have said, it is obvious that this honoring refers to your leadership and your contributions to the I-INCE and to global noise policy. But how to substantiate this honoring, how to endow it materially? It should be a memento, but should it add to the many articles for shelves you collected during your career already?

We finally decided to help you relive some of your memories in helping you and your fantasies by some specific memory and fantasy enhancer. We felt this might be a nice gift when we heard that you regret not to have had enough great sailing tours during your active sailing time. We thus would like to encourage you to make up for this by memory. We then thought this could be combined by making you memorize the highlights of your I-INCE presidency, the four congresses you lead in the European/African region, Nice and The Hague, in

2000 and 2001, in the Pan-American area, Dearborn in Michigan in 2002, and finally in the Asia-Pacific region, Jeju in South Korea, in 2003.

We thus will send to your home in Göteborg three bottles of excellent wines representing the three regions of the before-mentioned congresses together with a special glass engraved to make you not forget us, the community of noise control engineers—as long as you drink wine at least.

However, to not leave you empty-handed here, we complete this bottle series by a fourth for the first of your four INTER-NOISE congresses, the one in France. We followed advice of well-informed circles that you like good, real champagne, and there it is, a good such bottle to enable you to celebrate yourself wherever you want! Drink it with Margareta, who always appeared to be an impressive and engaging first lady of I-INCE!

Let me congratulate you for receiving this well-earned award, and let me congratulate us for continuously benefitting from the fruits of your many efforts!

Joachim Scheuren
President I-INCE

Bill Lang

Bill Lang's Passing

I am very sorry to say that Bill Lang passed away recently. His obituary is included in this edition. I had just been with him at the Technology for a Quieter America Workshop in Washington, DC, ten days before. It was a real shock to learn of his death. Bill was a real pioneer in the field of noise control and was an active participant up to the last days of his life. There was a session honoring Bill's contributions at INTER-NOISE 2015 where he and George Mailing received medals for their contributions to the field. For more on Bill's contributions, click here.

Bill went from playing a fundamental role in the development of noise regulations in the United States to playing a leading role in the founding of the Institute of Noise Control Engineering of the United States (INCE-USA) and the International Institute of Noise Control Engineering (I-INCE). Bill wrote an early history of INCE-USA, which can be found on the INCE-USA website here, or viewed as a PDF document here.

We have lost one of the pioneers of noise control and an outstanding individual. Bill be missed by many, but his contributions to the field and the institutions he helped to establish will live on.

Jim Thompson
Managing Editor
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William Warner Lang Obituary

William Warner Lang, 90, physicist, b. Boston, August 9, 1926; d. October 23, 2016. The only son of William Warner and Lila Gertrude (Wheeler) Lang, Bill joined the Navy and served from 1944 to 1947. He continued to serve in the Naval Reserve and was promoted to Captain in 1968. He studied physics and received BS and PhD degrees from Iowa State University and a MS from MIT. In the summer of 1954, he met the love of his life, Asta Ingard, visiting her brother, Uno, from Sweden. They were married 2 months later and spent nearly 50 happy years together.

After finishing his PhD in acoustics in 1958, Bill was recruited by IBM to build an acoustics laboratory in Poughkeepsie and develop a noise control program for the company. In the early 1970s, Bill worked with Senate staff in Washington, DC, on details of what would become the Noise Control Act of 1972. This initiative led to the formation of the Institute of Noise Control Engineering (INCE) in 1971, of which he was a founding member. He was also a founder of the International Institute of Noise Control Engineering (I-INCE) in 1974 and the INCE Foundation in 1993. Bill was recognized for his contributions to noise control throughout his career with fellowships in the Audio Engineering Society, American Association for the Advancement of Science, Acoustical Society of America, and the Institute of Electrical and Electronics Engineers. He was a fellow, Distinguished Noise Control Engineer, and a past president of INCE-USA, as well as an honorary member of the Institute of Acoustics (UK) and the National Council of Acoustical Consultants. He encouraged others to become engaged and was a mentor to many noise control engineers. The achievement he was most proud of was his election to the National Academy of Engineering in 1978. He was honored to represent IBM not just in the field of acoustics but all of engineering. He realized that IBM could benefit from a similar institution to recognize its best engineers and nurture collaboration. He pushed his idea to create the IBM Academy of Technology, which today boasts more than 800 members from 40 countries. Bill

William Warner Lang (1926–2016)

dedicated his career to influencing US and global noise policies through annual INCE-sponsored international congresses, now in their 44th year. His work continues today through the NAE Technology for a Quieter America initiative.

Bill was an active member of the community. In his "free" time, he counseled students as a member of the MIT Educational Council, started a Toastmasters Club—which he attended every week—was an Adjunct Professor of Physics at Vassar College, was a member and President of the Poughkeepsie/Arlington Rotary Club, and was a devoted member of Christ Episcopal Church where he sang in the choir. Bill loved life and challenged himself mentally and physically every day. He skied until he was 87, went to the gym, and walked every morning. Always cheerful and positive, he loved his family, friends, and animals big and small.

He is survived by his son Robert, daughter-in-law Bogumila, and 2 grandsons Lucjan Olaf and Colin.

A memorial service will be held at 11:00 a.m. on Saturday, November 19, at Christ Episcopal Church. In lieu of flowers, donations may be made to Christ Episcopal Church, 20 Carroll St., Poughkeepsie, NY 12601.

Source: Published in the *Poughkeepsie Journal* on Oct. 30, 2016.

Pan-American News

Acentech's James D. Barnes Receives the 2016 Laymon N. Miller Award from INCE-USA

Principal Consultant James D. Barnes, PE, INCE-USA Fellow, has received the Laymon N. Miller Award for Excellence in Acoustical Consulting, provided jointly by INCE-USA and NCAC. Jim was honored with this prestigious award at the INCE NOISE-CON 2016 conference.

In reviewing Jim's nomination, the award committee bestowed Jim with this honor based on his impressive professional accomplishments, education and mentorship of industry colleagues, technical knowledge and writing, and flattering endorsements from clients and colleagues. They write:

"Like Laymon, Jim clearly exemplifies the qualities of an outstanding acoustical consultant and has during his entire 40+-year professional life. His unwavering commitment to both the quality of his work and service to his clients is clear to all who have worked with him. In addition, his professional ethics are second to none."

"Jim is a clear and effective communicator and writer of technical reports, explaining just what clients need to know, as Laymon recommended, in ordinary language, not scientific or technical jargon."

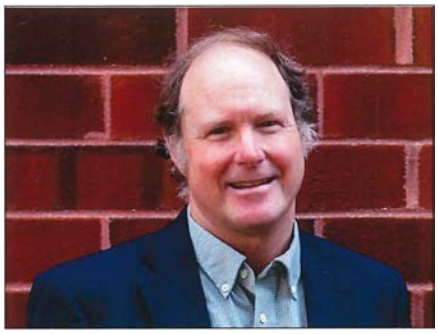
"Jim has given much time and effort into mentoring the next generation of noise control engineers . . . much like Laymon Miller himself."

Jim Barnes served first as a mentee and now serves well as a mentor to many young (and some not-so-young) colleagues. In his paper[1] "Mentoring—The Future of Our Profession" he offers the following conclusion: "Effective mentoring requires regular, thoughtful, and respectful interaction between colleagues. This mentoring benefits not only the mentee, mentor, and company, but also our profession, clients, and society." The editorial[2] he coauthored for the November 2013 issue of *Sound & Vibration*, "Mentoring—Support for the Future of Our Profession," is also noteworthy in this regard.

Jim has served for more than 40 years as an outstanding acoustical consultant on at least 1,000 projects throughout the United States and other countries, including Canada, Ireland, Colombia, and Turkey. He began his acoustical consulting career in 1973 where he learned the consulting profession working with colleagues such as Laymon Miller, Bob Hoover, Bob Bruce, Istvan Ver, Paul Jensen, and Eric Wood. He quickly earned the reputation from colleagues and clients as a go-to consultant managing projects requiring prediction, measurement, evaluation, and control of noise on an ever-increasing range of project types.

At Acentech, Jim concentrates on noise and vibration control, with an emphasis on resolving community and workplace noise issues in the power industry. As examples of his acoustical consulting service, he has applied his expertise to electric-power generation projects ranging in size from less than 1 MWe to more than 1000 MWe, including combined-cycle and conventional coal, gas, oil, wood, and nuclear-fueled steam-electric stations, as well as resource recovery, combustion-turbine, reciprocating engine, wind turbine, compressed air, and solar plants, plus transmission, distribution, and standby electric power facilities.

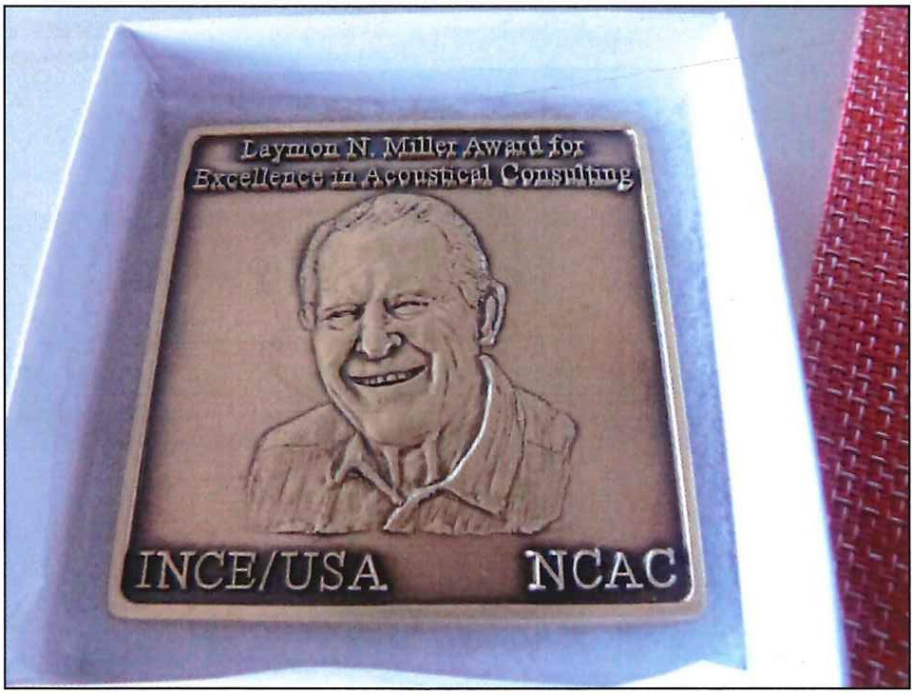
Throughout his 40-year career in noise and vibration control, Jim has authored



hundreds of technical reports for clients and presented at industry conferences. In 2012, Jim was designated an INCE-USA Fellow for "decades of outstanding professional service as an industrial and environmental noise control engineering consultant to clients throughout the United States, service to INCE-USA during NOISE-CON conferences and INTER-NOISE congresses, and teacher of classes for INCE-USA."

Jim has to his credit over 20 publications and oral presentations made here in the United States as well as overseas in Puerto Rico, Canada, China, and France. In addition, he co-organized the well-attended International Electric Power Industry Noise Abatement Engineering workshops in Stockholm, Paris, Toronto, and Cambridge. Jim provided four invited presentations at the Technology for a Quieter America workshops hosted by the National Academy of Engineering during 2014 and 2015. Jim also served as a coauthor[3] with Laymon Miller preparing the popular environmental noise manual *Power Plant Construction Noise Guide*.

Jim is a registered professional engineer in Massachusetts, Maine, New Hampshire, New York, Pennsylvania, and Virginia. He received a master's of engineering in mechanical engineering and a bachelor of science in mechanical engineering,



both from Cornell University, and completed additional graduate study at the Massachusetts Institute of Technology.

Notes

1 James D. Barnes and Eric W. Wood, "Mentoring—The Future of Our Profession." INTER-NOISE 2012, New York, August 2012.

2 James D. Barnes and Eric W. Wood, "Mentoring—Support for the Future of Our Profession," *Sound & Vibration*, November 2013, http://www.sandv.com/home.htm.

3 James D. Barnes, Laymon N. Miller, and Eric W. Wood, *Power Plant Construction Noise Guide* (New York: Empire State Electric Energy Research Corporation, 1977).

Asia Pacific News

China

The Biennial Acoustics Conference of ASC

The 2016 Biennial Acoustics Conference of the Acoustical Society of China (ASC) was successfully held in Wuhan, China, between October 29 and 30, 2016. The conference was hosted by the ASC and the Ship Vibration and Noise Key Lab of China, under the aegis of CSIC Institute 701 and Hubei Acoustic Society. The conference attracted interests and attentions of more than 350 prestigious professionals and outstanding scholars in the fields of sound and vibration. Four distinguished professionals were invited to give keynote speeches. More than 200 papers were collected. The conference awarded the "Chinese Journal of Acoustics Best Paper Award."

The 1st International Workshop on SHM for Railway System

The 1st International Workshop on Structural Health Monitoring (SHM) for Railway System cohosted by CRRC Qingdao Sifang Co., Ltd., CRRC Industrial Institute, and Stanford University was successfully held in Qingdao, China, between October 12 and 14, 2016. The theme was "looking back to development of structural health monitoring technology and looking forward to future application of structural health monitoring technology in railway industry." Thirteen keynote speeches were organized, as well as different forms of communication including special report, oral report, and poster presentation. Over two hundred academicians, scholars, and industrial experts from 13 countries and regions attended the workshop and shared their ideas on new technologies of structural health monitoring for railway system. More than one hundred papers were collected, and six papers were awarded the Excellent Paper Award. The International Workshop on SHM for Railway System will be held every two years to contribute to establishing an international high-level platform for exchanging and sharing structural health monitoring technology and to promote rapid development and application of structural health monitoring technology in railway system.

(News source) Jun Yang

Japan

Recent INCE/J Social Contribution Activities

INCE/J took part in a special event of "Children's Experiencing Manufacturing Fair," held on November 5–6, 2016. The venue was Sumida Small-to-Medium-Sized Manufacturing Enterprises Support Center in Sumida Ward, Tokyo, Japan. INCE/J provided a booth, where more than six hundred children enjoyed making whistles out of straw and voice driving copters by hand.

Recent Special Edition of the INCE/J Journal

The Journal of the Institute of Noise Control Engineering of Japan, Vol. 40, No. 5, published this October, is the 40th anniversary special issue. It contains a general review "Celebrating the 40th Anniversary of the Institute of Noise Control Engineering of Japan," 15 reviews concerning the progress over the past 40 years in various research fields on noise and vibration, 6 technical reports for the future of noise control, and a letter "Expecting a Future Acoustic Environment—Ten Years After The 30's Anniversary Symposium."

INCE/J Research Work Commissioned by the Japan Ministry of the Environment

INCE/J recently started a research project to study the following three work items under the contract with the Japan Ministry of the Environment.

1. Investigation for promoting noise and vibration mitigation measures
2. Analysis of measurement data of railway noise
3. Public awareness activities for noise/vibration regulation laws

New Research Committee Set Up in INCE/Japan

INCE/Japan newly set up a research committee associated with aerodynamic noise. The committee consists of six members, including Dr. Yoshiyuki Maruta as the head of the committee, and aims to illustrate aerodynamic noise problems and their practical mitigation measures to engineers.

2017 Spring Research Meeting of the ASJ

The 2017 Spring Research Meeting of the Acoustical Society of Japan will be held March 15–17, 2017, at Meiji University, Kawasaki, Japan (http://www.asj.gr.jp/annualmeeting/ASJ2017springCFP(E).html). The meeting chair is Professor CHOI Pak-Kon. The meeting is planned to have the following four structured sessions: (1) Basic acoustics 3—acoustic signal processing, (2) Research trend on the measurement, evaluation, and control of environmental vibrations, (3) Sound design strategy for marketing and branding, and (4) Acoustic environments and handicapped accessibility: Learning about the "Act for eliminating discrimination

against persons with disabilities." The proceedings of this meeting will be published as a CD-ROM. A booklet of collected abstracts and the meeting program will be distributed at the meeting site. Note that 926 participants were present and 512 papers were presented at the latest 2016 Autumn Research Meeting of the ASJ. Note also that more than six hundred papers have been submitted from Japan for the coming 5th Joint Meeting of the Acoustical Society of America and Acoustical Society of Japan in Honolulu Hawaii.

(News sources) Kiyoshi Nagakura, Secretariats of INCE/J and ASJ

Book Reviews

Treatise on Acoustics

E.F.F. Chladni
Springer-Cham Heidelberg, New York/Dordrecht/London, (2015)
227 pp., hardbound, 129 USD,
ISBN: 978-3-319-20360-7
eBook, 99.00 USD

This book is the first English translation of Ernst Florens Friedrich Chladni's (1756–1827) famous book *Die Akustik*, originally published in 1802 in German and in 1809 in French. This translation has been provided by Robert T. Beyer (1920–2008), former professor of physics at Brown University, based on the French edition.

Chladni (pronounced "clutnee" in English, like the u in "clutch") is mainly known to the acoustics community for the generation and illustration of modal patterns of beams and plates with different boundary conditions (in German called "Chladnische Klangfiguren," in English: "Chladni's tone/clang figures"). With plates, he investigated a variety of different shapes: not only rectangular and circular plates, but also triangular and hexagonal plates, plus ellipses and semicircular plates, always using a violin bow for excitation. These kinds of modal patterns can be found—more or less—in any basic textbook on acoustics and in any language around the world. Ernst Florens Friedrich Chladni was born in Wittenberg, the native place of the Protestant Reformation initiated by Martin Luther. Chladni's father was professor of law at Wittenberg University. His ancestors, being protestants, fled a century earlier from central Slovakia (at that time part of the Hungarian Kingdom) for religious reasons. It is no wonder that Ernst Florens was also supposed to study law, or that he finalized his studies with a PhD degree in 1782. Due to the strict regime of his father, Ernst Florens was not allowed to learn a musical instrument until the age of 19. Soon after his father's death, he became interested in experimental acoustics and also studied the works of Leonhard Euler und Daniel Bernoulli. In an earlier book, *Entdeckungen über die Theorie des Klanges*, already published in 1787, Chladni described geometrical eigenfunctions and characteristic frequencies (as we would call them now) not only for transversal waves but also for longitudinal waves of strings and beams.

Without doing any harm to others working in the new field of acoustics at that time, we can definitely call Chladni the first experimental acoustician, though Euler and Bernoulli studied transversal and longitudinal vibrations earlier, but only theoretically. Chladni's book, *Treatise on Acoustics*, can, therefore, be seen as a kind of review on his own work covering more than 25 years of physical studies of wave phenomena.

The book is split into four parts (with a number of sections in each thereof):

1. Numerical Ratios of Vibrations (2),
2. Characteristic Vibrations of Sounding Bodies (10),
3. On Transmitted Vibrations, or the Propagation of Sound (2), and
4. On the Sensation of Sound: On the Hearing of Men and Animals (2).

Each part has numerous chapters, albeit some are very short. The book's appendix shows Chladni's figures also being an annex in the original book. At the end of several sections, annotations made by Chladni are inserted in grey text boxes providing further explanation to literature from that time and other details. A preface written by Robert T. Beyer gives an account on the state of acoustics in 1800.

In part 1, starting with musical instruments and their harmonic ratios of tones, Chladni develops consonant and dissonant intervals and chords, ending up in a table providing numerical ratios of tone intervals and corresponding string lengths. In the second section, he addresses the concept of temperament applied to real musical instruments.

Part 2 addresses "sounding bodies" and so leads the path to a kind of acoustics, not just looking at musical instruments, by introducing also the direction of vibration: transverse, longitudinal, or even torsional by establishing reference to corresponding figures in the appendix. Subsequently, he treats vibrations of strings, stretched membranes, airflow in wind instruments, rods and strips, and even bended rods (like tuning forks and rings), always assuming constant thickness. But, Chladni, being aware of the fact that rods and strips with an uneven size and thickness show a different behavior, writes that those object types "could be the subject of much research." In this part in chapter 95 on "Distortions of the Figures," he addresses—for example—the effect of distortions of the nodal lines at a plate caused by touching and/or holding the plate at different locations along the perimeter. With some goodwill, one could see these experiments as a kind of first insight into damping effects at plates. Further he discusses modal patterns of plates (made of glass or a "sonorous" metal sheet, i.e., with low damping) depending on boundary conditions (two ends free, one fixed, two fixed). Chladni also develops some basic ideas on the behavior of three-dimensional bended surfaces, such as bells and vessels, by studying low-order modes by pouring water covered by some organic, plant-based powder into a bucket with the bell inside and observing the water being driven outward by the bell's vibrating modes. This reveals that Chladni was a clever experimenter, knowing how to set up a proper experiment and also to impress others. For this reason, he was invited to Europe's courts and palaces of that time to present his experiments. He gave a lot of public lectures, and also increased his income as a part-time lecturer at Wittenberg University through entrance fees. He was so well trained with his

devices that he was able to reproduce any kind of experiment and its result at any location and upon request by the audience.

In the book's third part, he addresses sound propagation through the air and other gases. From his writing it is clear to him that the sound propagation in air is based on longitudinal waves, while rigid bodies may have different kind of wave types. He assumed clearly that propagation is based on local fluctuations of "sound rays" not causing any transport effect of the air volume being involved. He discusses the speed of sound in the atmosphere (as already measured by Cassini and others) and the speed deviations due to local wind speed fluctuations and effects we nowadays call "diffraction in the atmosphere." Further, he discusses megaphones, ear trumpets (used as hearing aids), speaking chambers, also called whispering galleries, and echo effects. Finally, he ends in a chapter "on the construction of halls that are favorable to sound" paving the way to room acoustics, and he discusses sound propagation in water by experiments. The final part addresses the hearing of men and animals. Besides the description of outer and inner parts of the ear, he lists some speculative ideas about the transmission, sensation, and impression of sound by the auditory system. At that time, it was not clear whether the ear itself is causing sensation and impression or whether the cortex is involved and to what extent.

On the whole, the book gives a good and detailed insight into the times of prenumerical acoustics around 1800. Robert T. Beyer's book can be recommended to those willing to study in detail what the thoughts of a leading experimental physicist were—despite the fact that they were all called "philosophers" at that time.

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Neurally Based Measurement and Evaluation of Environmental Noise

Yoshiharu Soeta and Yoichi Ando
Springer, Japan, (2015)
264 pp., hardbound, 129 USD
ISBN: 978-4-431-55431-5
eBook, 99.00 USD

This book is the compilation of the research results gained during 40 years of work by the authors, namely by Yoichi Ando from Kobe University (Japan), on the measurement and evaluation of environmental noise based on an auditory neural and brain-oriented model. Ando is known to the acoustics community by the books *Concert Hall Acoustics* (1985) and *Architectural Acoustics* (1998), and from numerous scientific papers as one of the main contributors establishing the so-called "subjective preference theory" describing hearing sensations. The basic idea of this theory is that the auto-correlation function (ACF) and the interaural cross-correlation function (IACF) for audible signals arriving at both ears provide a representation for judging the subjective preference and the spatial sensations of sounds and noises.

The book, besides an introduction, is structured into nine chapters. Each chapter ends with a very extensive reference list, which is referred to in the chapter's text. The chapters are described here.

"Signal Processing Model of Human Auditory System" describes the auto-correlation model of the auditory system as developed by Ando, covering also the relation to loudness and to the much more complex term "annoyance." The majority of the studies by the authors included use factor analysis as a method.

"Noise Measurement Method Based on the Model" introduces auto-correlation function and interaural auto-correlation function, first used by Ando in 2001, to describe sound quality on a subjective basis. These studies lead to an auditory brain model enabling calculation of ACF and IACF on a personal computer from real-time data.

"Temporal Primary Sensations of Noise" and "Spatial Primary Sensations of Noise" both study attributes enabling the ability to distinguish sounds independent of location (i.e., temporal) or dependent on location (i.e., spatial). Time-dependent sensations such as pitch, loudness, timbre, and duration can, based on Ando's theory, be extracted as temporal factors from the auto-correlation function. This holds as well for factors describing spatial sensation based on IACF. Both chapters describe a neuropsychological model for temporal and spatial sensations, and explain studies performed with test persons to prove the validity of the model. The chapter on spatial sensations also uses the parameter Apparent Source Width (ASW) as a subjective attribute being used to evaluate the room acoustical performance of concert halls and opera houses.

"Noise Measurements" uses conventional parameters for describing noise (e.g., SPL and NC) and, on the other hand, ACF and IACF to characterize different kinds of noises by measurements such as aircraft noise, road traffic noise, flushing toilet noise, railway noise in train stations and in train cars as well, and to footfall noise on floors in buildings.

"Annoyance of Noise" applies the concept of subjective preference to establish some heuristic scale value to different kinds of noises such as pure tones, band-pass noises, and noise in relation to spatial factor (e.g., due to IACC fluctuations). Following the previous chapter, the annoyance resulting from this concept is studied for the noise types already discussed. The chapter closes with a "general equation for annoyance," enabling the calculation of a scale factor that is the sum of two scale factors, one for the left ear, and one for the right.

"Short-Term Effects of Noise" studies the effect of noise (again described by ACF and IACF) on short-term effects such as speech

and sleep disturbance. The experiment correlates the results from listening tests using syllables with measured ACF and IACC data obtained in an anechoic chamber. Finally, cases of nonidentification measured vs. calculated are compared. Further studies refer to the effect of noises even at low levels, or the subjective duration of noises in relation to their SPL (e.g., with sound/noise being present, "time passes faster than in silence").

"Long-Term Effects of Noise" reviews literature on long-term effects of noise on measurable factors such as human placental latogen, birth weight, reaction of sleeping babies (by PLG and EEG), and effect on height growth of children.

"Application to Sound Design" discusses rules based on ACF and IACC for sound design. For example, the subjective diffuseness of music is discussed. This leads to the path of listening experiments using a binaural auralization of music and sounds, thus not requiring a real room or a setup requiring the knowledge of where to place the listener. Further, the authors study such an arrangement to evaluate the effect of background noises on the listening level of music in train cars. The chapter closes with the subjective preference for birdsongs, which indicates that birdsongs could improve pleasantness of a soundscape. The most pleasant birdsongs are performed by cuckoo and Japanese grosbeak—no wonder.

The book closes with some 14 lines of text on "Urban Soundscape Design," mentioning that a clear definition of the term "soundscape" is still missing. This, however, is no longer fully correct since ISO/TC43/SC1 has published ISO/DIS 12913–1, "Acoustics—Soundscape—Part 1: Definition and Conceptual Framework" in July 2013. Now, at least, two pages with terms and definitions on soundscapes exist. A second part is in committee draft stage (ISO/CD 12913–2, "Acoustics—Soundscape—Part 2: Data Collection" in July 2016), providing more and detailed guidance on how to perform soundscape studies.

To conclude, this book gives a detailed overview of the achievements in the evaluation of noise based on the subjective preference theory. Certainly, the book does not focus on consulting engineers or acousticians in industry or administration since it focuses very much on details of correlation-based models of the hearing system. It gives, however, a complete overview of the state of the art on this subject, being most relevant to students and scientists working in the field of auditory models.

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Can You Hear Me?: Making the World a Quieter Place—My Life as an Unwitting Entrepreneur

Martin Hirschorn
Acoustical Publications, Bay Village, OH, (2007)
373 pp., hardcover, 25 USD
ISBN: 978-0-9769816-0-2

Journey to Greatness: The Story of Brüel and Kjær

Jackson Mowry and Ghita Borring
Acoustical Publications, Bay Village, OH, (2012)
225 pp., hardcover, 35 USD
ISBN: 978-0-9769816-3-3

Reader, you are in luck. Read this single review and you get "two reviews in one" at no additional cost. I am reviewing both together because they are stories and biographies of some very well-known people in acoustics. Not only are they well known, but the companies they founded are really imbedded in the acoustics vocabulary for many of us readers.

I knew all of the main actors here, Martin Hirschorn, Per Brüel, and Viggo Kjær, because I worked for both of their companies, Industrial Acoustics Co. and Brüel & Kjær, respectively. In both companies, I was a minor character—I had no real friendly working relationships with the bigwigs, but I knew many of the people that are discussed in the books.

Can You Hear Me? is a very interesting book. Hirschorn wrote it after he left Industrial Acoustics Company (IAC) and, in very readable text, traces his early life and the foundation of the company to the time he sold it, and even afterward. It consists of 26 chapters with a table of contents that is so detailed it could almost be an index. The TOC alone is 20 pages. The end sections deal with acknowledgements, appendices, and an index.

The book has two parts. Part 1, with eight chapters and 124 pages, is titled "From Germany to England and America." Part 2, with 18 chapters and 338 pages, is titled "My 49 Years with Industrial Acoustics Company," which, for those of us who knew Martin, is the most interesting. Suffice it to say, Part 1 deals with Martin's childhood, his education, his family's history and some of his adventures. Part 2 begins with his start in New York and goes all the way to his selling the company. He talks about people I worked with and admired, from John Duda, Nick Kreminic, and Mort Schiff to John Handley, among others. He tells of disputes and differences between him and many people in and out of IAC. In this part, he also talks about his family and the death of his wife. The chapters are as follows:

- Early Days in New York
- Start Up
- Putting IAC on the Map
- New Products, New Markets
- The South Bronx
- Managing Expansion—From Coast to Coast
- Quieting Jets and Air Conditioners
- Coping with Crises
- Across the Atlantic
- Into Asia
- In and Out of South Africa

- Our Sales Force
- The People Who Almost Unmade IAC
- IAC Laboratories
- Coping with Competition
- Selling the Company
- A Great and Complementary Marriage, Alena Wels Hirschorn
- My Life Today

This is a fascinating book—a bit rambling, but sufficiently detailed to show the trials and pleasures Martin Hirschorn experienced in his life, especially his experiences with IAC. To see how one person (with help) created a really large and influential company in noise control and how he dealt with problems and eventual sale is really interesting. Those of us who knew IAC in its heyday will very much appreciate this book. A thorough review of this book by the late Warren Blazier and the late "Red" Wetherill can be found here: http://www.sandv.com/books/review01.pdf.

Journey to Greatness is the story of another giant company in the field of noise control and acoustics. We all know Brüel & Kjær and I suspect a lot of readers over the age of 50 or so probably worked for the company. It is hard to believe that a small country like Denmark could have fostered and produced a world leader in the field of acoustical instrumentation.

This book has a preface by Ghita Borring, followed by acknowledgments by the second author, Jackson Mowry. For all of us readers of Sound and Vibration, we know him as the publisher, Jack Mowry. Jack worked for Brüel & Kjær and formed the first foray into the United States by Brüel & Kjær called B&K Instruments in Cleveland, OH. This acknowledgments section reads like a who's who in Brüel & Kjær. Almost all those names he cited are well known to many of us ex-employees. Appendix B gives names of those Brüel & Kjær employees who made significant contributions.

The 30 chapters, in four rough sections, are relatively brief, maybe 10 pages each, but really trace the history of the two founders and the company. Listing the sections might help give a flavor for the book and the emphasis:

- In the Beginning—chapters 1–5
- Road to Riches—chapters 6–22
- End of an Era—chapters 23–26
- Recovery and Recollections—chapters 27–30

Following the interesting concluding chapter 30, epilogue, there is a set of appendices worth listing:

A. The history of Brüel & Kjær from 1942 to 2000 in four sections along with major events in the world during those times
B. Brüel & Kjær golden anniversary notables
C. Consolidated financials—referenced earlier in the book
D. Family disagreement paralyzes Brüel & Kjær
E. Brüel & Kjær losing 3.5 million per week

In essence, the book is a history describing the lives of the two founders, the formation of the company, the shock on the company of the fall of Russia and China market 1986, the selling of the company to AGIV, what the founders learned from the failure of original organization, and the company's current status as a very strong and vibrant part of Spectris.

There is much discussion about the history of many of the instruments, analyzers, vibration meters, including the development of the studio mike, gas monitoring, medical ultrasound lines, and the VXI and PULSE instruments, while there is very little discussion about sound level meters, and only a brief mention of the Type 2203 (that long, green, heavy, meter with dials on the face, an analog needle indicator, and maybe a big box on the bottom where you select octave band or 1/3rd octave band frequencies for analysis).

There are discussions on how the literature and the seminar departments were started, something B&K was famous for. Also, there are stories of employees' experiences while part of B&K, and these stories are filled with personal remembrances.

As an ex-Brüel & Kjær employee, I was familiar with many of the names mentioned and stories discussed. Reading the book, I learned a lot of the details about the operation of the company and instrument development. However, I was surprised to see very little mention of the USA operation in Marlborough, MA—something I feel was a significant part of the company's history.

Written in an informal manner with sidebars in many of the chapters, this book is an easy and interesting read. I recommend this book to all present and former Brüel & Kjær employees and, to a lesser extent, all of us who used or are using Brüel & Kjær instruments. It is also recommended to those who think that big companies are invincible. Brüel & Kjær and Industrial Acoustics Co., discussed in *Can You Hear Me?* above, were the giants of instrumentation and industrial noise control, respectively. Then things happened.

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A Conceptual Framework for Noise Reduction

Jacob Benesty and Jingdong Chen
Springer International Publishing, NY, (2015)
89 pp., softbound, 54.99 USD
ISBN: 978-3-319-12954-9

Purpose

This is one of the spring briefs, which presents a concise summary of cutting-edge research and practical applications across a wide spectrum of fields. Featuring

compact volumes of 50–125 pages, the series covers a range of content from professional to academic. Typical topics might include: timely report of state-of-the art analytical techniques; a bridge between new research results, as published in journal articles, and a contextual literature review; a snapshot of a hot or emerging topic and in-depth case study or clinical example; and a presentation of core concepts that students must understand in order to make independent contributions.

This brief is intended to provide a solid understanding of the noise reduction problem, with a focus on speech processing, in order to design a well-targeted solution for a well-defined application. The authors propose a conceptual framework that can be applied to the many different aspects of noise reduction (or speech enhancement). The monaural or binaural noise reduction problem, in the time domain or in the frequency domain, with a single microphone or with multiple microphones, is presented in a unified way. Also, the derivation of optimal linear filters is simplified as well as the performance measures for their evaluation.

Chapter 1, "Introduction," provides a very brief description of the problem of noise reduction. The authors focus their discussion on the area of speech enhancement and speech processing, but the topic is meant to be applied to the general problem of signal enhancement.

Chapter 2, "Conceptual Framework," is the introduction of the author's proposed conceptual framework for noise reduction. This formulation gives a better insight into this fundamental problem. Within the framework, the authors define all important performance measures and criteria that will be of great help in the derivation of the most well-known estimators. Key discussions concern the definitions of speech intelligibility and speech quality that is used throughout the rest of the work. Sections include signal model, principle of the conceptual framework, performance measures, mean squared error (MSE)–based criterion, a summary, and references for this chapter.

Chapter 3, "Single-Channel Noise Reduction in the Time Domain," is identified as one of the most important schemes in the fundamental topic of speech enhancement since most communication devices have only one microphone and the time-domain processing seems intuitive and natural. While this approach has been well studied in the literature, this chapter revisits this method from the perspective proposed in Chapter 2. Sections include signal model, linear filtering, performance measures, MSE-based criterion, optimal filters, simulations, and references.

Chapter 4, "Single-Channel Noise Reduction in the Short-Time Fourier Transform (STFT) Domain with Interframe Correlation," studies the same problem in Chapter 3 but in the more convenient (STFT) domain. Contrary to most conventional approaches, the authors do not assume that successive STFT frames are uncorrelated. As a consequence, the interframe correlation is now taken into account and a filter is used in each sub-band instead of just a gain to enhance the noisy signal. Sections include signal model, linear filtering, performance measures, MSE-based criterion, optimal filters, particular case, simulations, and references.

Chapter 5, "Binaural Noise Reduction in the Time Domain," deals with the important problem in applications where there is a need to produce two "clean" outputs from noisy observations picked up by multiple microphones. This chapter approaches this problem with the widely linear theory in the time domain, where both the temporal and spatial information are exploited. Sections include signal model, widely linear filtering, performance measures, MSE-based criterion, optimal filters, simulations, and references.

Chapter 6, "Multichannel Noise Reduction in the STFT Domain," exploits the spatial information available from signals picked up by a determined number of microphones at different positions in the acoustics space in order to mitigate the noise effect. The processing is performed in the STFT domain. Sections include signal model, linear filtering, performance measures, MSE-based criterion, optimal filters, simulations, and references.

Summary and Recommendation

The brief is presented in six chapters, including a very short introduction on the topic. References are provided at the end of each chapter and point the reader to contemporary research as well as foundational studies in each area. The authors present their conceptual framework for studying the general problem of noise reduction in Chapter 2 and introduce two important performance measures: the speech intelligibility index and the speech quality index. Next, they propose a general MSE-based criterion from which all known estimators can be deduced. The remaining chapters show how to apply these different concepts to all classical noise reduction schemes. Excellent formulae, charts, and graphs are provided throughout the text, with many in full color.

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Acoustics for Engineers, Troy Lectures, 2nd Edition

Jens Blauert and Ning Xiang
Springer-Verlag, Berlin/Heidelberg, (2009)
253 pp., hardbound, 89.95 USD
ISBN: 978-3-642-03392-6

Purpose

This book concentrates on the classical aspects of engineering acoustics, with emphasis on physical acoustics and electroacoustics. According to the authors, it provides suitable material for an introductory course in engineering acoustics for students with knowledge

in basic mathematics and is based on extensive teaching experience at the university level. The book may be sufficient as the sole textbook for the subject of engineering acoustics; however, the authors recommend the accompanying guidance of an academic teacher.

Although the authors claim that this is an introductory course in engineering acoustics for students with basic knowledge in mathematics, this reviewer feels that the material and level of mathematics involved would be more suited to a third-year engineering student or graduate engineering student—one who has completed the requisite engineering calculus, physics, and mechanics coursework.

Each chapter deals with a well-defined topic and represents the material for a two-hour lecture. The chapters alternate between more theoretical and more application oriented concepts.

General Comments

The 1st edition title is assumed to be *Acoustics for Engineers*. This 2nd edition has corrected a number of typos and figures, and notations and equations have been edited to increase clarity of presentation. Additionally, a collection of problems that was absent in the 1st edition has been included. However, solutions to the problems are not provided; instead, the authors include an Internet link and state that solutions will be provided on a peer-to-peer basis.

As part of this review, this Internet link was used in an attempt to find solutions to each problem presented in the book. The website is not intuitive and it took considerable exploring to discover that one needed to click a "Log in" link in order to see the solutions, although no actual log-in or password was required. The solutions were laid out as a link for each chapter that opened a PDF containing the solution. Only the solutions to problems listed in Chapter 1 are provided on this website. The link for Chapter 2 is a broken link that returns a "file not found" error. The PDFs for Chapters 3–14 include only the text "Coming soon!" and "Solutions in German handwriting available upon request". The solutions for Chapter 1 include questions and details that are worded sometimes quite differently than those presented in the book. In total, there are only six answers/solutions provided from a total of 58 questions (most of them multipart) presented in the book.

The author's method of providing solutions to textbook questions is a puzzling choice. The best method would have been to include all solutions in an appendix within the text itself. The current method is wholly incomplete, confusing, and cumbersome.

Chapter 1, "Introduction," provides a brief but detailed overview of the basics starting with terminology and quantities, moving through particle velocity and displacement, and ending with logarithmic frequency intervals and double-logarithmic plots. The chapter includes many relevant figures, tables, and formulas.

Chapter 2, "Mechanic and Acoustic Oscillations," includes basic elements of linear, oscillating, and mechanic systems as well as acoustic systems, followed by free and forced oscillations of parallel mechanic oscillators. Discussion and mathematical details follow on energies and dissipation losses, and the chapter closes with a discussion and example of the Helmholtz Resonator.

Chapter 3, "Electromechanic and Electroacoustic Analogies," deals with simple linear, time-invariant mechanic and acoustic networks and their electric analogies. The text includes descriptions and formulae for electromechanic analogies and the electroacoustic analogy, as well as levers and transformers. Very detailed diagrams are provided for the rules for deriving analogous electric circuits; schematics are provided for synopsis of electric analogies of simple oscillators; circuit fidelity, impedance fidelity, and duality are discussed; and, examples of mechanic and acoustic oscillators are provided.

Chapter 4, "Electromechanic and Electroacoustic Transduction," presents the possibility of coupling electrical and mechanical domains, which results in a coupling of electric and mechanic energy and power. This topic is extremely important for modern acoustics and the authors restrict themselves to examples of practical importance. Included are sections on electromechanic couplers and two- or three-port elements, the carbon microphone—a controlled coupler, fundamental equations of electroacoustic transducers, reversibility, coupling of electroacoustic transducers to the sound field, pressure and pressure-gradient receivers, further directional characteristics, and absolute calibration of transducers.

Chapter 5, "Magnetic-Field Transducers," demonstrates that the force–law relationship between the mechanic force, F, and the coupled electric quantity, I, is either linear or quadratic, and provides methods of linearization in order to use quadratic force laws with linear transducers. Sections include the magnetodynamic transduction principle, magnetodynamic sound emitters and receivers, the electromagnetic transduction principle, electromagnetic sound emitters and receivers, the magnetostrictive transduction principle, and magnetostrictive sound transmitters and receivers.

Chapter 6, "Electric-Field Transducers," concentrates on basic principles of electric-field transducers and discusses some illustrative examples. Sections include the piezoelectric transduction principle, piezoelectric sound emitters and receivers, the electrostrictive transduction principle, electrostrictive sound emitters and receivers, the dielectric transduction principle, dielectric sound emitters and receivers, and further transducer and coupler principles.

Chapter 7, "The Wave Equation in Fluids," focuses on waves—those processes that

vary with both time and space. Unlike the preceding chapters dealing with vibrations, which are a function of time and can be expressed with common differential equations, this chapter uses partial differential equations to describe waves in fluids. Sections include derivation of the one-dimensional wave equation, three-dimensional wave equation in Cartesian coordinates, solutions of the wave equation, field impedance and power transport in plane waves, transmission-line equations and reflectance, and the acoustic measuring tube.

Chapter 8, "Horns and Stepped Ducts," considers one-dimensional propagation in a tube where the diameter varies with *x*. Sections include Webster's differential equation—the Horn Equation, discussions of conical and exponential horns, radiation impedances and sound radiation, steps in the area function, and finally, a discussion of dealing with stepped ducts by means of electric analogies.

Chapter 9, "Spherical Sound Sources and Line Arrays," discusses the basic solutions of the wave equation in spherical coordinates. Comparisons are made between periodical time signals that can be decomposed into Fourier harmonics, with spherical sound waves that are decomposed into spherical harmonics. Sections include spherical sound sources of the 0th and 1st orders, higher-order spherical sound sources, line arrays of monopoles, analogy to Fourier transforms as used in signal theory, and directional equivalence of sound emitters and receivers.

Chapter 10, "Piston Membranes, Diffraction and Scattering," focuses on line arrays from point sources where reflection and diffraction do not occur, which is a flat membrane in an infinitely extended, rigid plane baffle. Sections include the Rayleigh integral, Fraunhofer's approximation, the far and near fields of piston membranes, and general discussion on diffraction and scattering.

Chapter 11, "Dissipation, Reflection, Refraction, and Absorption," discusses the fact that a lossless medium is an idealization, and dissipation occurs in sound waves due to sound propagation through real media. Topics of discussion include dissipation during sound propagation in air, sound propagation in porous media, reflection and refraction, wall impedance and degree of absorption, porous absorbers, and resonance absorbers.

Chapter 12, "Geometric Acoustics and Diffuse Sound Fields," deals with sound fields inside rooms with complicated shapes, like concert halls or churches, using an approximate method called geometrical acoustics. Chapter sections include mirror sound sources and ray tracing, flutter echoes, impulse responses of rectangular rooms, diffuse sound fields, reverberation time formulae, and application of diffuse sound fields. This chapter has many practical applications in building and room design and provides many useful diagrams, figures, and formulae for the construction of habitable spaces.

Chapter 13, "Isolation of Airand Structure-borne Sound," discusses sound isolation and the confinement of sound to a space in such a way that transmission to neighboring spaces is totally or partially prevented, and differentiates this from sound damping. Sections include sound in solids—structure-borne sound, radiation of airborne sound by bending waves, sound transmission loss of single-leaf and double-leaf walls, the weighted sound reduction index, isolation of vibrations, and isolation of floors with regard to impact sounds.

Chapter 14, "Noise Control—A Survey," is a discussion of the nature of noise, measurement techniques, and method of noise abatement. Sections include origins of noise, radiation of noise, noise reduction as a system problem, and noise reduction at the source, along the propagation paths and at the receiver's end.

Chapter 15, "Appendices," includes expanded details on previous topics, additional formulae, and sample acoustic engineering problems. Sections include complex notation for sinusoidal signals, complex notation for power and intensity, supplementary textbooks for self-study, exercises, and letter symbols, notations and units.

Summary and Recommendation

Blauert and Xiang's enlarged 2nd edition of *Acoustics for Engineers* provides comprehensive material for an introductory course in engineering acoustics for students with knowledge in engineering calculus, physics, and mechanics. The text is designed for extensive teaching at the university level under the guidance of an academic teacher. Chapters progress from linear mechanical and electromechanical sound propagation through air, to more complex wave acoustics in varying dimensional configurations, and provide very clear schematics, figures, formulae, and conversion equations. This book would be a welcome addition to an educator on the topic or to a practicing acoustic engineer. One downside to the text is the omission of solutions to the included exercises for each chapter.

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Acoustical Sensing and Imaging

Hua Lee
CRC Press, Boca Raton, (2016)
122 pp., hardback, 89.95 USD
ISBN: 978-1-4987-2573-6
eBook, 62.97 USD

This book is a succinct well-written book summarizing the various mathematical approaches to acoustical sensing and imaging. Hua Lee provides by example the necessary foundation to help the reader determine the methodology for an imaging application that will result in a better resolution based on the given constraints

and requirements of the specific application. The format of the book provides the essential technical tools and background essential to understand, compare, and then use the various mathematical fundamental processes. These technical tools include details of the core elements of signal processing that are required to enhance the image, such as the signature of the waveforms, image reconstruction algorithms, and error minimization.

The examples provided include medical imaging, underwater acoustics, sonar imaging, tomographic acoustic microscopy and geophysical signal processing. While not all applications are utilized in the examples, the ones used are sufficiently diversified to demonstrate the result of each theoretical approach. This in turn facilitates the understanding of the weaknesses and strengths of the different methods and the subtle differences between them. Procedures to improve the system performance are also explained, including the correction of quadrature phase errors prior to image reconstruction.

The step-by-step theoretical framework of the book comes from the fact that the book has been used for a graduate course in acoustic imaging. Hua Lee is known for his pioneering research laboratory. This facility and associated work provided the clear imaging pictures that are used in the book to help demonstrate some of the differences of the various approaches.

Although Hua Lee is also the author of other books with substantial content on imaging technology and engineering, one of the assets of this book is that it is short and concise. The back cover of the book, often made available online prior to ordering the book, provides an excellent summary of the book's theoretical content.

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Rock and Pop Venues: Acoustic and Architectural Design

Niels Werner Adelman-Larsen
Springer, Berlin, (2014)
451 pp., 139 USD
ISBN: 978-3-642-45235-2

Comprehensive acoustic and architectural surveys of music halls have been published in books authored by Leo Beranek (1962, 1996, and 2004) and Michael Baron (1993 and 2010). Their books address halls for unamplified classical music performance. *Rock and Pop Venues: Acoustic and Architectural Design* takes a similar approach and format but covers acoustic requirements for performance venues presenting pop and rock music. The author states that in his native Denmark, over 80 percent of music performances are of popular music, yet little research has been conducted to determine suitable acoustic requirements for this music genre.

Niels Werner Adelman-Larsen passionately makes the case in his book that acoustics of pop and rock performance venues are a critical factor for audience enjoyment and the requirements of musicians and sound mixing engineers presenting the show. This has been undoubtedly gained from his experience as a touring musician (drummer) for 17 years, having played in hundreds of European venues both large and small.

The book comprises seven chapters and four appendices. The text is written in a narrative style with little mathematics. A reader without an acoustics background should be able to understand the concepts as these are briefly explained where needed in a commonsense manner. Room acoustic principles and auditorium acoustics are briefly covered in Chapters 1 and 2. The basics of room acoustics and the standard acoustic metrics used to evaluate performance venues are described so the reader has sufficient information to understand the results of the music venue surveys covered in later chapters.

Electronic sound systems for music amplification are covered in Chapter 3 to include a description of the primary loudspeaker system types, where they are best positioned in the room, and how they affect the audience and musician experience.

Chapter 4 summarizes a survey the author conducted in 2005 of 20 Danish rock and pop venues. The acoustic measurement and subjective assessment results from this survey were used as a basis for the author's MS thesis awarded by the Danish Technical University and his ASA Journal paper, "Suitable Reverberation Time for Halls for Rock and Pop Music."

Chapters 5 and 6 synthesize the results of the Danish venue survey and the author's performance experience to develop acoustic and architectural design criteria suitable for the needs of pop and rock music venues. Some of the key design principles include: (1) the importance of low-frequency clarity in the 63 to 250 Hz octave bands for the general impression of hall acoustics; (2) reverberation time at 125 Hz should be shorter than the adjacent octave frequency bands; (3) the established design principle for classical music venues whereby low-frequency reverberation time is increased to provide acoustic "warmth" should not be applied to pop and rock venues; (4) clarity for pulse, rhythm, and timing (PRAT) is important for the bass guitar and bass drum, which sets the propulsion and rhythmic timing for the song; (5) the best rated halls with 1000 to 3000 m3 volume have frequency independent reverberation times between 0.60 and 1.2 seconds; (6) the need for similar acoustic conditions on stage as the audience area to enable performers to feel connected with the audience; and (7) a standing audience absorbs approximately five times the energy at mid- and high-frequencies compared to low-frequencies and needs to be accounted for when designing the venue.

A gallery of 55 European and UK pop and rock venues is presented in Chapter 7,

similar in format to the 20 Danish venues covered in Chapter 4. The venues surveyed range from small clubs to large arenas, including purpose-built facilities—some funded by local governments to give youth a place for recreation—to the repurposing of older industrial buildings. Several important venues are surveyed, such as the Cavern Club in Liverpool and the Kaiserkeller in Hamburg, both where the Beatles honed their musical skills prior to "Beatlemania," and the Wembly Arena and the Hammersmith Apollo in London, where many arena-rock acts recorded classic live albums.

The book concludes with four appendices, three of which are alike. Appendix A tabulates the architectural and acoustic measurement results and data interpretation from the European and UK venue survey of Chapter 7. Appendix B is similar but is restricted to selected acoustics metrics with data presented in the octave frequency bands between 63 and 4000 Hz. Appendix C simplifies the Appendix A data for 26 of the 55 venues. Statements from two respected sound system engineers on their priorities and preferences for venue acoustics round out Appendix D. Plan and section drawings with accompanying graphic scale and black-and-white photos are provided for each of the 75 venues. Many drawings appear to be from poor quality originals and some features are obscured. The opposite is the case for some venue photographs which are reproduced too darkly, obscuring detail. Typographical errors are few but the book could use a bit of editing to improve grammar in several paragraphs.

Rock and Pop Venues: Acoustic and Architectural Design should have a wide appeal to acousticians working in room acoustics design. While there may not be many popular music venues that seek the services of an acoustician, much information contained in this volume is applicable to the design of contemporary worship facilities.

Overall, I enjoyed this book and learned about an acoustics topic not addressed in traditional room acoustics books. Now if I can just convince guitarist Nigel Tufnel to turn down his volume on that Marshall stack from "11"!

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Acoustics: An Introduction to Its Physical Principles and Applications

Allan D. Pierce
Acoustical Society of America, 1st ed. (1981), reprint (1989)
678 pp., hardcover, 33 USD
ISBN: 978-0-88318-6121

Overview and Purpose

This has become a classic textbook in the field of acoustics. Originally published in 1981, there have been new or revised editions published in 1989 and 1994. This latest version, published by the Acoustical Society of America, is a reprint of the 1994 edition. One of the useful additions to the later editions has been the inclusion of solutions to the problems at the end of each chapter.

I have used this book for some time and have found it to be well written and useful in teaching classes, and as a resource when dealing with unusual or difficult acoustic issues. It is in all sense a textbook. There is a series of problems at the end of each chapter. The author begins the text with fundamental principles and builds from basic examples at the beginning of each chapter. It is definitely appropriate for a graduate level class with rigorous treatments and complex mathematical derivations and explanations. The final governing equations are not simply presented, but their development and underlying principles are described in detail. As a textbook of considerable depth, the text provides limited examples of applications and does not attempt to provide convenient approximations or rules of thumb for easy computation.

This is not a noise control textbook in the sense that numerous practical examples are provided or recommendations are made for noise attenuation in common control problems. While the performance of barriers, silencers, and other control devices are described and governing equations are developed, the goal is not to recommend or describe practical applications. It is, however, an excellent text to understand the principles behind common controls and understand how they will perform. This text is highly recommended as a graduate level text in acoustics or as a component in a graduate level course in noise control.

Organization and Material Presented

1. The Wave Theory of Sound
This chapter is a comprehensive introduction to acoustics. It begins with a brief historical overview and takes the student through a comprehensive derivation of the wave equation. Beginning with basic principles, the student is taken through the concepts of both atmospheric and underwater acoustics. In addition, the concept of sound power is presented.

2. Quantitative Measures of Sound
This chapter begins by defining frequency and frequency bands. Measures such as levels, weighting, and filters are also described. As would be expected in such a segment, the concepts of level addition are discussed. The concepts of transfer function and stationary process are also introduced in discussing signals and measurement.

3. Reflection, Transmission, and Excitation of Plane Waves
This chapter begins with basic principles discussing wave reactions with solids.

The basic concepts of plane waves are provided and explained. The important concepts of coincidence frequency and transmission loss are also introduced. A thorough mathematical definition of the phenomena is provided. The transmission loss segment introduces the concepts and examines the performance of common materials.

4. Radiation from Vibrating Bodies
Once again starting from basic principles, the author builds a description of sound radiation from simple to more complex bodies. Radiation from classic shapes and the complex radiation patterns from realistic radiation surfaces are described for the student. The use of the Helmholtz equation to describe radiation is discussed in some detail. A final segment presents the concept of reciprocity and discusses microphone calibration.

5. Radiation from Sources near and on Solid Surfaces
This chapter presents a very comprehensive discussion of both the near field and far field effects of sound radiation from a source near a reflecting plane. The classic concept of a piston in a reflecting plane is described and analyzed in considerable detail with mathematical formulations for both the near and far field.

6. Room Acoustics
This is one of the most comprehensive room acoustics treatments of which this reviewer is aware in a single text. From basic principles such as the energy balance in the room it shows the relevance of the classic formulation for describing the sound field in a room. The important principles of reverberation time, diffusivity, and energy correlation in a room are presented. The measurement of absorption and transmission loss is also described and discussed in considerable detail. The modal analysis of a room is presented with the discussion of special cases at low and high frequency. In the final segment of the chapter, the principles of statistical energy analysis are discussed and the use of this method in room acoustics is demonstrated.

7. Low-Frequency Models of Sound Transmission
This chapter is a comprehensive treatment of sound transmission in ducts and the use of silencers. Since the author focuses on the basic principles and does not use industrial examples, the context may be a little difficult to see in the beginning of the chapter. However, this is a comprehensive treatment including horns, duct terminations, Helmholtz or side branch resonators, expansion chambers, and orifices.

8. Ray Acoustics
This chapter presents a thorough introduction to ray acoustics. The propagation of sound in a moving field, the effects of density gradients, and multiple types of reflecting surfaces are discussed. The basic principles of ray tracing computations are provided in this chapter. The practical application of these principles is not discussed in detail, nor are there specific examples provided.

9. Scattering and Diffraction
Both scattering and diffraction are discussed in detail in this chapter. Specific geometric and resonant condition of scattering are described, and detailed mathematical descriptions are presented. The concept of Doppler shift is presented and its use in measuring flow velocities is described. A thorough treatment of diffraction is provided for a number of well-defined geometric concepts. The treatment of barriers and edge effects is a perfect example of how this text provides a detailed mathematical description instead of the approximation of rules of thumb found in many noise control texts.

10. Effects of Viscosity and Other Dissipative Processes
Beginning with the Navier–Stokes model, this chapter looks at sound dissipation in multiple ways. The concepts of dissipation in a tube with multiple modes and reflections are discussed. The concept of sound absorption materials is examined in considerable detail with discussions of many of the fundamental principles.

11. Nonlinear Effects in Sound Propagation
This chapter focuses on the nonlinear waveform, the "N" wave, and the impact of propagation. Ballistic shocks and sonic booms are also discussed in this context.

12. Appendix
Answers and Hints to Problems

13. Indices
Name Index and Subject Index

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The Foundations of Acoustics: Basic Mathematics and Basic Acoustics

Eugen Skudrzyk
Springer-Verlag, NY, (1971)
790 pp., softbound, 99 USD
ISBN: 978-3-7091-8257-4

Overview and Purpose

This book is not a textbook in the sense that it is not designed to take the student from the basics of acoustics or acoustical mathematics to more advanced topics. It is more a collection of chapters on topics in acoustics and mathematics related to acoustics. There are no student problems included. The materials do proceed in a logical manner, building from basic principles to more advanced topics. However, it is organized in a manner that would be conducive to a student learning acoustics. I would classify this as a reference book on acoustics and on the mathematics related to acoustics. There is a heavy emphasis on the mathematics, but the author does a good job relating the applications in acoustics. If I were a

graduate level student in acoustics or a researcher in the field, this book would be very valuable. I only wish I had had it when I was a student.

Chapters 1–8 (see the list of chapters below) provide a complete mathematical background for someone studying or working in acoustics. A thorough understanding of these chapters would provide an excellent foundation for anyone working in acoustics. The author builds from basic nomenclature to complex analyses through these chapters. With examples using electrical circuits, point mass systems, and different input functions, it is clear how the material is related to the field of acoustics. However, there are no problem exercises or practical examples provided. The use of the mathematics described is not shown in "real world" examples.

Chapters 10–12 provide an excellent foundation for signal analysis in acoustics. Including sampling theory and basic signal processing concepts, these chapters provide a good foundation of the mathematics and principles of signal analysis.

Chapters 13–28 are specific to defining the mathematics of sound, sound radiation, sources, diffraction, reflection, and other acoustic phenomena. The equations governing the sound radiation from shells, pistons, and geometries are treated in detail. The mathematics for reflections from various surface definitions are well described. Many complex radiation and diffraction problems are also defined.

This book provides a comprehensive treatment of a number of topics in acoustics and the mathematics of acoustics. It is well organized and clearly written. It clearly leans heavily to the mathematics and does not delve into practical applications and certainly not noise control. As noted above, chapters 1–8 provide an excellent foundation in the mathematics related to acoustics. Chapters 10–12 are an excellent start in signal processing. The remaining chapters, 13–28, provide detailed mathematical explanations of sound, sources, radiation, and diffraction. Where the topics align with the reader's interests they can be very useful. However, these chapters are not practical instructions in the application of acoustics or noise control. In summary, I would say that this is an excellent foundation for the mathematics of acoustics and a great reference for the mathematics applicable to particular problems in acoustics.

Organization

Historical Introduction, pages 1–5

1. Equations and Units, pages 6–16
2. Complex Notation and Symbolic Methods, pages 17–32
3. Analytic Functions: Their Integration and the Delta Function, pages 33–77
4. Fourier Analysis, pages 78–94
5. Advanced Fourier Analysis, pages 95–122
6. The Laplace Transform, pages 123–130
7. Integral Transforms and the Fourier Bessel Series, pages 131–136
8. Correlation Analysis, pages 137–148
9. Wiener's Generalized Harmonic Analysis, pages 149–151
10. Transmission Factor, Filters, and Transients (Küpfmüller's Theory), pages 152–200
11. Probability Theory, Statistics, and Noise, pages 201–235
12. Signals and Signal Processing, pages 236–269
13. Sound, pages 270–283
14. The One-Dimensional Wave Equation and Its Solutions, pages 284–294
15. Reflection and Transmission of Plane Waves at Normal Incidence, pages 295–312
16. Plane Waves in Three Dimensions, pages 313–325
17. Sound Propagation in Ideal Channels and Tubes, pages 326–343
18. Spherical Waves, Sources, and Multipoles, pages 344–377
19. Solution of the Wave Equation in General Spherical Coordinates, pages 378–391
20. Problems of Practical Interest in General Spherical Coordinates, pages 392–422
21. The Wave Equation in Cylindrical Coordinates and Its Applications, pages 423–454
22. The Wave Equation in Spheroidal Coordinates and Its Solutions, pages 455–488
23. The Helmholtz Huygens Integral, pages 489–511
24. Huygens Principle and the Rubinowicz–Kirchhoff Theory of Diffraction, pages 512–556
25. The Sommerfeld Theory of Diffraction, pages 557–592
26. Sound Radiation of Arrays and Membranes, pages 593–640
27. The Green's Functions of the Helmholtz Equation and Their Applications, pages 641–662
28. Self and Mutual Radiation Impedance, pages 663–676

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ROCKFON Supports WELL's Focus on Improving Human Health and Environment through Optimized Acoustics

Chicago—Supporting the WELL Building Standard™ (WELL) goal to optimize building performance for human health and the environment, and projects pursuing WELL Certification, the ROCKFON business shares its recommendations for creating comfortable interior spaces through Optimized Acoustics™.

Contributing to successful, acoustical office designs, ROCKFON Alaska®, Color-All™, Koral™, Tropic® and Sonar® acoustic stone wool ceiling panels help meet shorter reverberation times, and higher Noise Reduction Coefficient (NRC) values, even exceeding 0.90.

WELL is a performance-based system that measures, certifies, and monitors features of the built environment that impact human health and well-being in new and existing office buildings, their cores and shells, and their interiors. Currently in Version 1.0 (v1), Feb. 2016, WELL examines seven concepts: air, water, nourishment, light, fitness, comfort, and mind.

ROCKFON ceiling systems can contribute to several Optimization Features detailed in the Comfort section of WELL v1. The WELL concept of Comfort seeks to "create an indoor environment that is distraction-free, productive, and soothing. Solutions include design standards and recommendations, thermal and acoustic controllability, and policy implementation covering acoustic and thermal parameters that are known sources of discomfort."

"Personnel costs in commercial buildings significantly outweigh the costs for design and construction and maintenance and operations. ROCKFON Optimized Acoustics and ceiling systems can reduce costs and add value, and ultimately, improve human well-being in office buildings," says Gary Madaras, PhD, acoustics specialist at the ROCKFON business leading its Optimized Acoustics program.

"In alignment with WELL, ROCKFON recommends using ceiling systems that optimize absorption and, where needed, using walls or plenum barriers to effectively block sound between rooms," explains Madaras. Elaborating, he cites the Optimization Features for WELL Certification of New and Existing Interiors:

- Feature 78 calls for maximum Reverberation Times (RT60) to decrease stress and maintain comfortable sound levels through the use of sound-absorbing materials. Conference rooms are specified at 0.60 seconds and open office spaces at 0.50 seconds, which follows the trend toward more stringent absorption criteria.
- Feature 80 also requires spaces to incorporate absorptive surfaces to help with reverberation management and improve privacy and acoustic comfort. It refers to using ceilings with high NRC values to achieve this. Open office spaces need ceilings with a minimum NRC 0.90 for 100 percent of the ceiling. Conference and teleconference rooms need ceilings with a minimum NRC 0.80 for at least 50 percent of the ceiling.
- Feature 81 addresses noise from adjacent spaces using sound barriers to reduce transmission.
    - Noise Isolation Class (NIC) is the field measurement of total sound isolation between two rooms, specified by WELL as: NIC 40 for enclosed offices without sound masking; and NIC 53 for conference and teleconference rooms or for private offices with adjoining walls. NIC is similar to Sound Transmission Class (STC) values, which are laboratory measurements of the wall construction alone.
    - Also part of this section on sound barriers, WELL notes that all interior walls enclosing regularly occupied spaces be properly sealed along the top and bottom tracks. This commonly would be interpreted as using full-height walls and preventing noise leaks to isolate sound between adjacent spaces.

Supporting projects pursuing WELL Certification, the ROCKFON business offers its Optimized Acoustics program and an extensive portfolio of ceiling systems for optimizing the acoustic experience of commercial interiors, including sound-absorbing ceiling panels, baffles, and islands. To learn more about how ROCKFON products may contribute to achieving the Optimization Features for WELL Certification of New and Existing Interiors, please email cs@rockfon.com, call 800-323-7164, or visit OptimizedAcoustics.com.

Note: The ROCKFON business and its products are not affiliated with or endorsed by the International WELL Building Institute or the WELL Building Standard. To learn more about WELL, please visit www.wellcertified.com/well.

* *News release—view online*

ROCKFON North America Facility Construction on Schedule, Progress Involves Global Collaboration

Chicago—Construction of the first ROCKFON North America manufacturing facility is on schedule to begin production in Mississippi by mid-2017. The exterior shell is taking shape and equipment is scheduled to arrive in the first quarter. A grand opening celebration will be planned once the new facility is operational.

Global Collaboration

The ROCKFON business is the leading supplier of stone wool acoustic solutions, a subsidiary of Denmark-based ROCKWOOL International A/S and an affiliate to ROXUL Inc. The Mississippi facility will be the fifth ROCKFON manufacturing facility in the world, extending global capacity and meeting the growing demand for ROCKFON stone wool acoustic ceiling products in North America.

To date, nearly 100 ROCKWOOL and ROXUL associates from around the world have provided their knowledge and time on the ROCKFON project to meet the highest standards on design, construction, equipment, materials, and safety. Leading the project is ROCKFON managing director John Medio, with involvement from ROXUL president Trent Ogilvie. ROCKWOOL Group's Jean-Michel Grivotte acts as both project manager and project executive.

"The global collaboration on this project defines its success," says Medio. "ROCKWOOL Group associates have provided valuable guidance to our North American teams to ensure that we will add the same high quality and performance products to our global capacity as offered by our other facilities."

Based in the United States, Peter Regenberg, ROXUL vice president of operations, and Tom Smith, ROCKFON business development manager, have served as project executives from the earliest stages of the North America facility's development. They were part of the key working groups who traveled to Poland to observe best practices and apply them in Mississippi.

Construction Progress

In March 2016, the ROCKFON business broke ground in Marshall County, Mississippi, on its new facility. Located adjacent to the existing ROXUL facility, it will span 130,000 square feet (12,000 square meters) with room for future expansion.

Since the groundbreaking, the design-build team of Allen & Hoshall architects

and Flintco construction managers has been preparing the site. The site has been excavated and graded. The concrete foundations have been poured. The steel has been erected. Finally, the exterior shell is taking shape.

The new facility in Mississippi will manufacture ROCKFON stone wool acoustic ceiling products. The ROCKFON business will continue to manufacture its specialty metal ceiling panels and Chicago Metallic suspension systems in its Chicago and Baltimore facilities. Chicago Metallic suspension systems also are manufactured in Belgium, Malaysia, and China. Other ROCKFON stone wool manufacturing facilities are located in the Netherlands, Poland, France, and Russia.

* *News release—view online*

ROCKFON Ceiling Systems Contribute to Education Spaces and a Better Way to Learn

Chicago—ROCKFON ceiling systems help students, teachers, and staff benefit from optimized acoustics, healthy and safe indoor environments, sustainability, and aesthetics. "Education Spaces—Ceiling solutions for a better way to learn" shares new lessons in designing effective school, college, and university interiors. The new 16-page publication is available free for download here.

"Many students are now spending more time at school and this affects the way we design and build for education. It forces us to innovate by using building materials that tackle specific challenges, such as noise, indoor air quality, fire safety, and lighting. ROCKFON stone wool ceiling products can help balance between quality, performance, and value," says Chris Marshall, ROCKFON vice president of marketing.

"For educational facilities' design, functionality usually tops aesthetics. But both are possible and both have an important impact on students' progress through the academic year," adds Marshall. "For example, color can affect how we process information. Yellow is associated with creativity and blue with better concentration."

Students' concentration and understanding their lessons also has a deep connection with their ability to hear their instructors. "Creating a good acoustic experience improves learning and understanding. Every student should have the same opportunity to hear and

Credit: Pepple Photography

understand what is being said. Due to its fiber structure, stone wool is one of those high-performing, sound-absorptive materials. It provides ROCKFON ceilings, baffles, and islands with excellent noise reduction capabilities," explains ROCKFON acoustic specialist Gary Madaras.

Marshall continues, "ROCKFON ceilings provide a great line of defense against indoor health hazards and support the newest educational building codes and regulations. Our ROCKFON stone wool ceiling panels are resistant to mold, bacteria, and humidity, and are GreenGuard® Gold Certified for low VOCs. This stringent certification process considers safety factors that may impact people who are more vulnerable, such as children and seniors."

In addition to referencing GreenGuard Gold certification, the U.S. Green Building Council's LEED® ratings also promote the advantages of daylighting for sustainable buildings. The white surface of ROCKFON ceilings can reflect up to 86 percent of available light. This better distribution of natural light helps educational facilities to lower electric lighting loads and reduce cooling costs, saving both energy and associated costs.

In addition to describing how to address the challenges of aesthetics, noise, indoor air quality, sustainability, and lighting, "Education Spaces" presents facts, statistics, and inspirational examples. The publication features a case study on Arkansas State University's Humanities and Social Services building and showcases images of educational interiors from campuses around the globe.

Among the ROCKFON ceiling systems that help create successfully designed education spaces are:

- ROCKFON Alaska®—elegant smooth white surface, best sound absorption, high fire performance, high light reflectance, in a choice of lay-in, tegular, and concealed edge designs
- ROCKFON Color-all™—34 exclusive colors, smooth surface, best sound absorption, high fire performance, in a choice of lay-in, tegular, and concealed edge designs
- ROCKFON Contour™—frameless acoustic baffles with high sound absorption
- ROCKFON Impact™—better sound absorption, high fire performance, high light reflectance, in square lay-in, a reinforced glass scrim enhances impact resistance
- ROCKFON Island™—frameless acoustic islands with high sound absorption, in a choice of square or rectangular formats
- ROCKFON Koral™—lightly textured white surface, better sound absorption, high fire performance, high light reflectance, in a choice of square and tegular edge designs
- ROCKFON Multiflex™—vertically installed acoustic baffles with high sound absorption, three-sided white frame or two-sided galvanized frame
- ROCKFON Sonar®—elegant lightly textured white surface, best sound absorption, high fire performance, high light reflectance, in a choice of lay-in, tegular, and concealed edge designs, various sizes and formats including planks
- ROCKFON Sonar Activity™—elegant lightly textured white surface, best sound absorption, high fire performance, high light reflectance, direct installation on to soffits maximizes ceiling height
- ROCKFON Tropic®—smooth white surface, better sound absorption, high fire performance, high light reflectance, in a choice of square and tegular edge designs

Learn more about these ROCKFON ceiling systems in "Education Spaces—Ceiling solutions for a better way to learn." Product guides and data sheets, specification and installation guidelines, and project examples also are available at http://www.rockfon.com. For additional support, please email cs@rockfon.com or call 800-323-7164.

* *News release—view online*

About the ROCKFON Business

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

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

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

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

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

For more information, visit www.rockfon.com.

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Scantek, Inc.

New UC-35P, 1" Low-Noise Microphone from Rion

The UC-35P 1" microphone/preamplifier combination is based on a new, free-field, pre-polarized, low-noise microphone capsule UC-35 and the CCLD compatible NH-35 preamplifier.

Highlights

- 4 dB(A) noise floor
- Free-field characteristics
- CCLD (Constant Current Line Drive) compatibility
- BNC connector enables connection to all types of CCLD compatible equipment
- Reliable and stable measurement results

Specifications

Nominal Diameter: 1 inch
Frequency response: Field
Frequency Range (Hz): 10 to 12500
Bias Voltage (V): 0
Maximum input sound pressure level (dB) (Linearity error +/–0.3dB: 96
A-weighted inherent noise (dB): 4
Temperature Coefficient (dB/Celsius): –0.008
Dimensions (mm): 23.8 (dia) × 132.7

For more information on the UC-35P, along with Rion's entire line of microphones and preamplifier, please download Rion's latest microphone and preamplifier catalog or contact us.

About Scantek

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

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

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

August 28–30, 2018
INTER-NOISE 2018
2018 International Congress on Noise Control
Chicago, Illinois, USA
http://www.inceusa.org/node/455

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