

NOISE/NEWS

Volume 17, Number 3
2009 September

INTERNATIONAL

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

SPECIAL ISSUE

Noise Control Engineering
Education in the Asia-Pacific
Region

MEMBER SOCIETY PROFILE

Austrian Noise Abatement
Association





The Institute of Noise Control Engineering's Annual Conference

NOISE-CON 2010

will be held jointly with the

159th Meeting of the Acoustical Society of America

at the

Baltimore Marriott Waterfront Hotel

700 Aliceanna Street, Baltimore, Maryland 21202 USA

Phone: 1-410-385-3000; Fax: 1-410-895-1900 Toll-free: 1-800-228-9290

NOISE-CON 2010 April 19-21, 2010

159th ASA Meeting April 19-23, 2010

NOISE-CON 2010 and Joint ASA-INCE Special Sessions, Abstract and Paper Submission Guidelines.

The 26th annual conference of the Institute of Noise Control Engineering, NOISE-CON 2010, will run concurrently with the 159th Meeting of the Acoustical Society on Monday through Wednesday (April 19-21, 2010), culminating with the Closing Ceremony which will take place with the ASA Awards Ceremony on Wednesday afternoon (21 October, 2010). Many of the Noise and some of the other ASA Technical Committee Sessions (e.g., Architectural Acoustics, Engineering Acoustics, Structural Acoustics and Vibrations) will be part of the joint ASA - NOISE-CON conference, thus forming an exciting and coherent program of noise control related sessions, which reflects the overlap in membership interests between the two organizations, and the spirit of co-operation that led to the decision to have this joint meeting. Note, there will be one registration fee for both conferences, so NOISE-CON 2010 participants are encouraged to take the opportunity to learn about some of the work being done in other areas of acoustics, not usually part of regular NOISE-CON technical programs, by attending the sessions taking place on Thursday and Friday.

Mike Lucas of Ingersoll Rand is the NOISE-CON 2010 General Chair. Courtney Burroughs, *Noise Control Engineering Journal* Editor is the technical program chair. All NOISE-CON 2010 information including abstract and paper submission instructions will be handled through the Institute of Noise Control Engineering (INCE) web site (<http://www.inceusa.org/NC10/>). Information about the NOISE CON 2010 special sessions and session organizers can be found at http://www.inceusa.org/NC10/tech_sessions.asp

Special Sessions

Special Sessions that will be part of the NOISE-CON 2010 program are being organized by INCE and also jointly by INCE and the ASA Noise, Architectural Acoustics, Engineering Acoustics and Structural Acoustics Technical Committees. The INCE organized Special Sessions are listed below and also in the complete special sessions list above. Technical papers in ALL areas of noise control engineering are welcome, so your paper need not be part of one the special sessions. However, if there is synergy with particular special sessions, suggest it be part of a particular session when you submit your abstract. More information about the special sessions and session organizers can be found at www.inceusa.org/NC10/tech_sessions.asp

Exposition

A MAJOR TECHNICAL EXPOSITION will be held at this joint NOISE-CON 2010 conference and 159th Meeting of the ASA. The exhibits will include computer-based instrumentation, multi-channel analyzers, sound quality systems, software for noise and vibration control analyses, acoustical materials, passive noise control devices, active control systems, and other products. Details regarding the exposition can be obtained from Richard J. Peppin of Scantek. Inc., who is the exposition manager.

Hotel, Travel Information and Registration

There is one registration fee for both conferences and registration for the conference will be handled by the Acoustical Society. Information will be posted on <http://asa.aip.org/meetings.html>. Hotel and travel information will also be posted on this site. The Baltimore Marriott Waterfront has their own web site <http://www.marriott.com/hotels/travel/bwiwfbaltimore-marriott-waterfront>. Note that there are several Marriott Hotels in the Baltimore area, make sure you are booking at this one for the conference.

NOISE/NEWS

INTERNATIONAL

Volume 17, Number 3

2009 September

Features

Asia-Pacific Education in Noise Control 76

Departments

President's Column..... 71

Editor's View..... 72

Member Society Profile..... 74

Product News 94

International Representatives..... 96

Acknowledgements 99

Conference Calendar..... 99

Directory of Noise Control Services 100

Cover Photo:

The INTER-NOISE 09 Banquet August 25, 2009

Editorial Staff

G. Maling, Jr., *Managing Editor*

60 High Head Road

Harpswell, ME 04079, USA

G. Ebbitt, *Feature Editor*

B. Berry, *European Editor*

M. Burgess, *Asia-Pacific Editor*

P. Donavan, *Pan-American News Editor*

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

Advertising Sales Manager

Richard J. Peppin

Scantek, Inc.

6450 Dobbin Rd. #A

Columbia, MD USA 21045

410-290-7726, 410-290-9167 fax

e-mail: PeppinR@ScantekInc.com

Produced by

INCE/USA

Noise/News International (ISSN 1021-643X) is a quarterly news magazine published jointly by the International Institute of Noise Control Engineering (I-INCE) and the Institute of Noise Control Engineering of the USA, Inc. (INCE/USA). *Noise/News International* is distributed to the Member Societies of I-INCE and to members of INCE/USA as a member benefit. Advertising sales are handled by Richard J. Peppin. Feature articles for this magazine are selected by the editors. Responsibility for editorial content rests upon the authors, and not upon I-INCE or INCE/USA, the Member Societies of I-INCE, or their members. Product information is published as a service to our readers, and does not constitute an endorsement by the societies or their members. **SUBSCRIPTIONS:** Members and Associates of INCE/USA and the Member Societies of International INCE receive *Noise/News International* as a membership benefit. Other individual or library annual subscriptions are 60 USD in the USA. Subscribers in other countries should add 10 USD per year for first class mailing to Canada and Mexico, and air mail postage overseas. Address inquiries concerning subscriptions to the INCE/USA Business Office, 9100 Purdue Road, Suite 200, Indianapolis, IN 46268-3165. **EDITORIAL CORRESPONDENCE:** Address editorial correspondence to George C. Maling, Jr., 60 High Head Road, Harpswell, ME 04079, USA. Telephone or FAX: +1 207 729 6430; e-mail: maling@alum.mit.edu.

COPYRIGHT AND REPRINT

PERMISSIONS: Copyright © 2009 by the Institute of Noise Control Engineering of the U.S.A., Inc. For all copying, reprint, or republication permission, contact the INCE/USA Business Office, IBO@inceusa.org.

ADVERTISING: For information about advertising, contact Richard J. Peppin, Advertising Sales Manager, Scantek, Inc., 6450 Dobbin Rd. #A, Columbia, MD 21045, e-mail: PeppinR@ScantekInc.com.

Printed in the United States of America



**International Institute of
Noise Control Engineering**

www.i-ince.org

Gilles Daigle, *President*
Hideki Tachibana, *Immediate Past President*
Robert Bernhard, *Secretary-General*
Jean Pierre Clairbois, *Treasurer*

Vice Presidents

Bernard Berry
Marion Burgess
Paul Donovan
Samir Gerges
Tor Kihlman
William Lang
George Maling
Rajendra Singh
Joseph Cuschieri

Directors

Hee Joon Eun
Josef Novák
Samir Gerges
David K. Holger
H. Temel Belek
Jing Tian



**Institute of Noise Control
Engineering of the USA, Inc.**

www.inceusa.org

2009 INCE/USA Officers

Patricia Davies, *President*
Paul R. Donovan, *Past President*
James K. Thompson, *President-Elect*
Steven A. Hambric, *Vice President—Technical
Activities*
Christopher W. Menge, *Vice President—Public
Relations*
Kenneth Kaliski, *Vice President—Board Certification*
Michael J. Lucas, *Vice President—Publications*
Eric W. Wood, *Vice President—Membership*
Steven E. Marshall, *Treasurer*
Todd Rook, *Secretary*
Joseph M. Cuschieri, *Executive Director*
George C. Maling, Jr., *Managing Director, Emeritus*

2009 INCE/USA Directors

J. Stuart Bolton
Paul L. Burgé
Patricia Davies
Paul R. Donovan
Gordon L. Ebbitt
Mardi Hastings
Deane B. Jaeger
Mandy Kachur
Richard Kolano
Charles T. Moritz
Ralph T. Muehleisen
Robert A. Putnam
Thomas E. Reinhard
Scott D. Sommerfeldt

NOISE/NEWS

INTERNATIONAL

The printed version of Noise/News International (NNI) 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).

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 46 Member Societies in 39 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 Internet Supplement

www.noiseneewsinternational.net

- Links to the home pages of I-INCE and INCE/USA
- Abstracts of feature articles in the printed version
- Directory of the Member Societies of I-INCE with links, where available, to the Member Society Profiles and home pages
- Links to I-INCE Technical Initiatives
- Calendar of meetings related to noise—worldwide
- Links, where available, to NNI advertisers
- Links to news related to the development of standards
- Link to I-INCE Technical Reports

The 38th International Congress and Exposition on Noise Control Engineering, INTER-NOISE 2009, held in Ottawa has now come and passed. The Congress Registration totaled 626 Full Registrations, 123 Student Registration, 66 Accompanying Persons, and 54 Exhibitors. The full Technical Program included 7 distinguished lectures. It takes a tremendous amount of effort to coordinate the organization of a Congress of this size. The Congress Co-Presidents, Trevor Nightingale and Joe Cuschieri, the Technical Program Co-Chairs, Bradford Gover and Stuart Bolton, as well as the entire Organizing Committee must be congratulated for a very successful Congress. *(A complete congress report will appear in the December issue of this magazine.—Ed.)*

In addition to the full Technical Program, a second CAETS (Council of the Academies of Engineering and Technological Sciences) Forum on *Worldwide Noise Sources* was held during a three day workshop concurrent with technical sessions. This Forum followed a first CAETS workshop on transportation noise sources in Europe—held in Southampton, UK, in June 2008. The goals of this second Forum were to cover other global noise sources not addressed in Southampton. I hope to provide a summary of the outcome of these workshops in a future editorial.

I am very pleased to announce an important new initiative of the International Institute of Noise Control Engineering, I-INCE. During its meeting in Ottawa, the Board of I-INCE approved a program to provide grants to young scientists/engineers. These grants are meant to assist young noise control scientists and engineers in attending the INTER-NOISE Congresses. The first of these grants will be made available for INTER-NOISE 2010 to be held in Lisboa, Portugal, 2010 June 13 – 16.

Funds have been allocated to support between ten and twelve grants, each having a value of 500 EUR. The grant will include complimentary registration for the congress. The remainder of the 500 EUR grant, will be available at the time of the congress as a contribution to cover part of travel and accommodation expenses. The notification of the award of the grant may be used to assist with

obtaining additional funding from other sources.

Candidates must be relatively early in their professional careers (typically less than 10 years of active career). They can be either undergraduate or postgraduate students, postdoctoral or young acousticians working in academia, government or industry.

Applications will be assessed by the I-INCE Grants Sub-committee Jury. Notification to the successful applicants will be provided in January 2010 along with their complimentary registration identification number. The awardee/applicant will need to complete registration, comply with the deadlines for submission of the abstract and the manuscript as prescribed at the INTER-NOISE 2010 website and to participate in the congress. To receive the remaining grant money the successful candidates must attend the congress and present their paper during the congress

The official website of INTERNOISE 2010, www.internoise2010.org will include the instructions for the submission and presentation of the papers (abstract and full text).

In addition to the grant initiative, the Board approved moving forward with the development of a proposal to create an I-INCE Symposium Series. The intent is that such symposia will provide expanded opportunities for participation in International-INCE-sponsored activities and meet the expanding needs of the discipline of noise control engineering. It is expected that funds will be allocated for this initiative starting next year. Full details will be provided in due course.

Together with the existing Technical Initiatives, it is hoped that these new initiatives will further stimulate technical activities for the benefit of I-INCE Member Societies and to meet the ever increasing needs of the discipline of noise control engineering. Finally, starting next year, I plan to invite some of the I-INCE Vice Presidents to write Guest Editorials describing the various I-INCE initiatives in more detail. ■

— Gilles Daigle
President, International INCE



Gilles Daigle
President,
International INCE

Education and the Noise Control Engineer



Marion Burgess

Asia-Pacific Editor

Just a year ago, my Editors View for Noise News International, started with “*It seems like education is a hot topic for consideration at conferences and meetings for acoustics.*” And now this issue contains the outcomes from a forum held on “Asia-Pacific Education in Noise Control Engineering.” It is apparent from this summary that there is diversity in the approach to education for those who take on the career of a noise control engineer. In some countries there is a strong component in the undergraduate engineering program but in others it is considered a specialty and undertaken at a higher degree level.

Much of the discussion at the forum was on the means to satisfy the needs of the industry for properly trained noise control engineers. In order to encourage more education opportunities in graduate education there is a need to promote the exciting and innovative aspects of a career in noise control. This is quite a challenge and needs the cooperative efforts of the profession, the industry and the educators. In those countries where there are insufficient opportunities in the formal education system it is up to the industry to become involved with provision of properly developed, rigorous courses or workshops and not just rely on “on the job” training.

It is also interesting to note from the forum summary that towards the end, the discussion focused on the effect of “public pressure” for improved noise control in all aspects of our life. “Public pressure” is evident in environmental noise issues where a community group that is, or

likely to be, affected by what they consider to be an unacceptable noise are able to drive a change. In order for the public to become fully involved in rational discussion on such issues it is important that they become “educated” on noise issues.

The wide availability and ease of access to information from the Internet is a great advantage. Members of a community action group can find a wealth of detail on noise and acceptability as well as examples of actions by other groups who were concerned about similar issues. This can lead to valuable discussions between all the stakeholders involved and ensure that the process is clear and transparent. However there is also the disadvantage that inappropriate or incorrect information can be easily found. This can lead to unproductive discussion as the authorities and agencies try to explain why the levels being quoted are inappropriate. On these occasions the independent information provided by government authorities and agencies can be of great assistance to clarify the issues. Many authorities do have such information but often do not make this information easy to find by the outside user. However there are some excellent examples. One that utilizes modern technology is the noise and flight path tracking software that allows the public to dynamically view the noise levels around airports.

The role of educating the public should be seen by the authorities to be an important part of their role. Efforts should be made to ensure that the information is presented in a manner that is utilizing the advantages of modern technology. 

— Marion Burgess
Asia Pacific Editor

New CCP Intensity Probe

- New pre-polarized intensity microphones
- Phase matched, IEC 61094 Class 1 compliant
- Complete kit with microphones, preamplifiers, cables and handle



G.R.A.S.
SOUND & VIBRATION

US office 23621 Lorain Road · North Olmsted · OH 44070, USA · E-mail: sales@gras.us · www.gras.us



DIDN'T YOU HEAR IT?
They must have used SoundPLAN®

NEW SoundPLAN 7.0 calculation core used in the world's biggest noise mapping project.

NEW

- Dynamic Search Projection Method
- Attribute Explorer
- Redesigned Indoor Factory Noise Model

ALWAYS

- Cutting edge innovation
- Superb graphics
- 50+ standards and guidelines tested and/or certified

SoundPLAN, the most used noise planning software because it's fast, accurate and dependable. Let us introduce you to SoundPLAN.

www.soundplan.com Tel: 1 360 432 9840



**Sound
PLAN**

Österreichischer Arbeitsring für Lärmbekämpfung (Austrian Noise Abatement Association)

The Austrian Noise Abatement Association (ÖAL) was founded as a section of the Österreichische Arbeitsgemeinschaft für Volksgesundheit (ÖAV) (Austrian Working Group for Public Health) in 1958 October. The administration was done in ÖAV with subsidies from the Ministry for Social Affairs, other Ministries, and the governments of the 9 Austrian Counties.

The founder and head of the Austrian Noise Abatement Association for the first 20 years was Prof. Friedrich Bruckmayer, a well known expert especially in the field of building acoustics. For the next 14 years Prof. Judith Lang managed the Austrian Noise Abatement Association. Her successors were Mathias Stani, Walter Gassner, Wolfgang Khutter and since 2005 Werner Talasch.

The technical activities were led by the Institute for Heat and Sound Technology. The main special tasks undertaken by the Austrian Noise Abatement Association included establishment of guidelines and dissemination of the fundamentals of acoustics and noise control.

Some of the most important guidelines in the first years were measurement of noise emission of machines, measurement of noise emission of vehicles, assessment of noise exposure (in the neighborhood and in the working place), effects of noise on man, the acoustical basics for the construction of factories, low noise machines, and the psychology of noise production by man. Later, guidelines were established for calculation methods for road traffic noise, aircraft noise zones around airports, rail

traffic noise, noise propagation outside and in factories, the basics for noise control in town and country planning, and noise labeling of machines.

In 1987, ÖAL Guideline 29 on low noise trucks was issued. This guideline defined the criteria for low noise trucks in harmony with criteria already existing in Germany. When the problems with high noise levels alongside the transit route from Germany to Italy through Austria became serious, the low noise truck guidelines were applied on the relevant Austrian roads during nighttime (combined with a speed limit to 60 km/h). The importance of low noise trucks grew rapidly in Europe and these trucks are now state-of-the-art.

In 1991, there were some difficulties financing the work of ÖAL within ÖAV, and in 1994 the ÖAV went into bankruptcy. At that time the *Österreichischer Arbeitsring für Lärmbekämpfung*, was founded as an independent association.

The aim of ÖAL is still unchanged; the dissemination of state-of-the-art information in noise control — especially through the preparation of guidelines in working groups and exchange of experiences in 4 plenary meetings per year.

The Austrian Noise Abatement Association sets also every year activities at the International Noise Awareness Day and manages the German version of the Dangerous Decibels program in cooperation with the Oregon Health & Science University, Portland.

For more information, contact the ÖAL at www.oal.at or via e-mail at office@oal.at.

Österreichischer Arbeitsring für
Lärmbekämpfung
Austrian Noise Abatement Association
Dresdner Straße 45/3.49
A-1200 Wien/Vienna
Österreich/Austria
Phone: +43 664 408 71 31
Fax: +43 2287 4963 

This is the 66th in a series of articles on the Member Societies of International INCE.

Member Society Profile is a regular feature of *Noise News International*. If you would like to have your society featured, please contact George Maling at inceusa@aol.com.

TAPPING JUST GOT EASIER!

The rugged brand new Norsonic N-277 Tapping Machine is ideal for making structureborne impact noise tests for floor/ceiling combination in the field and in the laboratory. This third-generation unit meets all international and US standards.

- Impact sound transmission testing according to ISO140 part VI, VII and VIII, ASTM E-492 and ASTM E-1007.
- Remote operation from hand switch or PC; Mains or battery operation.
- Low weight 10 kg (22 lb) incl. battery and wireless remote option.
- Built in self-check of hammer fall speed, and tapping sequence for automatic calibration of major components.
- Retractable feet and compact size provide easy transportation and storage.



Scantek, Inc.
Sound & Vibration
Instrumentation
and Engineering

www.scantekinc.com
info@scantekinc.com
800-224-3813

PHANTOM Powered

Measurement Mic System
IEPE/ICP Converter

7052 Type 1.5™
Titanium Diaphragm
3 Hz to >20 kHz
<20 dBA >140 dB SPL
MK224 Optional
4048 Preamp
2 uV "A" > 5 Vrms
4 Hz > 100 kHz
18 to 60 Vdc

For Digital Recorders For USB A/D Systems

Offers Superior
IEC1094 Type1
Long-term Stability
Temp and Humidity
Performance

Now in Stock

7052PH/MK224PH

A
c
c
e
r
a
t
i
o
m
e
t
e
r
s
,
M
i
c
s
&
m
o
r
e

P
h
a
n
t
o
m
t
o
I
C
E
P
P
E

Converter

ICP1248

ACO Pacific, Inc.
2604 Read Ave., Belmont, CA 94002, USA
Tel: 650-595-8588 Fax: 650-591-2891
www.acopacific.com sales@acopacific.com
ACOustics Begins With ACO™

What's a **SLARM™**? Sound Level Alarm

**PDA & Laptop
Displays
Wired
Wireless**

- Equipment Monitoring ■ Protect Hearing
 - Environmental Monitoring ■ Production Test
 - 100dB ranges 20-120 and 40-140 dB SPL
 - A,C,Z weighting ■ Alert and Alarm Settings
 - DynLeq™ - Dynamic Leq ■ 4Mb History
 - Type 1.5™ and Type 1 Measurement Mics
- ACO Pacific, Inc.**

2604 Read Ave. Belmont, CA 94002 USA
Tel: 650-595-8588 Fax 650-591-2891
www.acopacific.com acopac@acopacific.com
ACOustics Begins With ACO™

Asia-Pacific Education in Noise Control

Janet Moss, Noise Control Foundation; e-mail:noisecontrolfoundation@gmail.com

Introduction

Education in noise control engineering in Europe and the United States was surveyed in workshops held during 2007 in Spain and the USA respectively. The article on noise control engineering education in Europe was published in the March, 2009 issue of this magazine; the article on noise control engineering education in the USA was published in the September, 2008 issue. This article is based on a forum held in Shanghai, China on October 27, 2009 as part of INTER-NOISE 08.

The objectives of the Shanghai forum on "Asia-Pacific Education in Noise Control Engineering" were to:

- Determine if the demand for noise control engineers in Asia-Pacific countries is greater than the supply provided by the universities in these countries;
- Identify the components of a typical curriculum in noise control engineering relating to several sub-specialties such as the design of low-noise products, building acoustics, and measurement/instrumentation technology including model curricula;
- Assess the ability of higher education to supply noise control engineers and identify the universities that offer curricula on noise control engineering; and
- Describe the mathematical preparation that students need and the background in the social, psychological, and physiological sciences required for a career in noise control engineering.

The goals of the workshop were to:

- Identify the institutions in each country (universities and other) that influence the engineering curricula in that country.
- Prepare a typical curriculum in noise control engineering including required courses to cover the following sub-specialties:
- Design of low-noise products (control at the source)
- NCE applications (control by path interference)
- Noise control in buildings
- Measurement and instrumentation technology
- Modeling techniques including FEA, SEA, etc.
- Identify all institutions in the Asia-Pacific region offering education in noise control engineering and its related specialties.

William W. Lang chaired the sessions which consisted of panelists from China, Japan, Korea, Hong Kong, Australia, and India gave presentations on NCE education at their university:

Following the morning session and each afternoon session there was a discussion period during which forum participants asked questions of the panelists or contributed additional information on NCE education in the Asia-Pacific region.

Session 1

Panelists

- Prof. Xiaojun Qiu, Nanjing University, China

- Prof. Akira Omoto, Kyushu University, Japan
- Prof. Jeong-Guon Ih, KAIST, Korea

Presentations

The Noise Control Engineering Course in Nanjing University

Professor Xiaojun Qiu, China

Nanjing University was founded in 1908 and is one of the top eight universities in China. The University has about 62 departments, 127 institutes, 700 professors, 11,000 postgraduate students and more than 32,000 undergraduate students. The Institute of Acoustics of Nanjing University is one of the top two Acoustics Institutes in China, and has more than 14 professors and about 100 postgraduate students. The research area covers Physical Acoustics, Photo Acoustics, Ultrasonics, Audio Acoustics, and Audio Signal Processing. The noise control group consists of staff from the Audio Acoustics and Audio Signal Processing research areas, and there is one professor, one associate professor, three lecturers, and more than 20 postgraduate students in the group. The group owns two full anechoic chambers, one reverberation room, a set of sound insulation rooms, and a listening room. The hardware in the institute includes various equipment and instruments such as a 16 channel Pulse Multi Analyser and Head Acoustics Analyser, and the software includes Odeon, Ease, Ansys, and Virtual DSP.

Nanjing University is the only university in China which offers a Bachelor degree

in Acoustics. The students who major in Acoustics are with the Department of Electronic Science and Engineering, which also has Electronic Engineering and Communication Engineering majors. The general courses for the students of all majors include Mathematics, Physics, Electronics, Computer, and Signal Processing. The special courses for students majoring in Acoustics include Fundamentals of Acoustics (2x2 hours per week for 16-18 weeks), Electroacoustics (3x1 hours per week for 16-18 weeks), Ultrasonics (3x1 hours per week for 16-18 weeks), *Principles of Noise and Vibration Control* (3x1 hours per week for 16-18 weeks), Architectural Acoustics (3x1 hours per week for 16-18 weeks, elective), Audio Engineering (2x1 hours per week for 16-18 weeks, elective), Principles of Acoustical Measurements (2x1 hours per week for 16-18 weeks), and Acoustical Measurement Experiments (3x1 hours per week for 4 weeks).

The contents of the Noise Control Engineering (NCE) Course in Nanjing University are Fundamentals and Basic Terminology, Noise Level Criteria, Sound Sources, Outdoor Sound Propagation, Sound Barriers, Sound Power Measurement, Room Acoustics, Sound Absorption, Sound Transmission through Partitions, Insulation Structures, Dissipative Mufflers, Reactive Mufflers, Vibration Absorbers, Vibration Isolation, Active Noise Control, and Structure Borne Sound. The general objective of the course is to understand the physics of noise generation, propagation, and perception; to understand the principles of noise and vibration control measures; and to practice the methods and techniques of noise and vibration control. The references include a number of noise control books in Chinese and English. The goals of the NCE Course in Nanjing University are to interest the students by citation of the latest international scientific publications, to let

the students know the fundamentals by using intensive math and derivations, and to let the students to learn the practical design methods by having intensive exercises and practical projects.

There are about 30 undergraduate students majoring in acoustics every year, and 60-90 percent of them enter postgraduate programs such as acoustics, physics, biology, architecture, mechanical engineering, electronic engineering, and ocean engineering. Of those, 10-20 percent go overseas, 20-30 percent stay at Nanjing University, and 30-40 percent go to other universities or Institutes in China. Only 10-40 percent of the undergraduates go directly for jobs after graduation.

When the students enter postgraduate programs, the acoustics courses they study include Principles of Sound Radiation, Nonlinear Acoustics, Sound Propagation in Solids, Modern Acoustics Experiments, Acoustics Progresses, Photo Acoustics, Thermo Acoustics, Fundamentals of Medical Ultrasonic, Acoustic Electronics, and Modern Digital Signal Processing. There usually are seminars every week in each research group. The students also need to write a degree thesis; the thesis for a master's degree usually takes 1-2 years and the thesis for a doctoral degree usually takes 3-5 years. The topics of the thesis usually target on new knowledge, techniques and methods in the area of sound generation, propagation, perception, and control.

The demand for students who majored in acoustics comes from education and research institutes, government departments, industry, companies, and manufacturers. For the universities and research institutes, their postgraduate program enrolls undergraduates while teaching and/or research positions need master and doctoral degree students. The government institutes such as the

national or local institutes of metrology and environmental monitoring stations need both undergraduate and postgraduate students. The companies that hire the acoustics students include communication companies (noise in communications), electronic device companies (loudspeakers, microphones); and both undergraduate and postgraduate students are required. However, few students find a job in companies with noise and vibration control engineering (perhaps because of salary). The current situations are that every undergraduate who majored in acoustics can find a job after graduation, and industry demands more high-degree students with specialized knowledge in acoustics.

In summary, for the students who majored in acoustics at Nanjing University, the demand for noise control engineers is greater than the supply provided by the University. The contents of the current undergraduate curriculum in the noise control engineering course at Nanjing University only cover the basic knowledge and technologies. More components relating to specific subjects such as numerical methods of SEA, FEM, and BEM, structure-borne sound, modal analyses, and measurement methods are needed in the noise control practice and scientific research. These can be provided as advanced courses or postgraduate courses, and Nanjing University has the ability to supply the advanced courses and training for noise control engineers.

Curriculum of Acoustical Engineering in Kyushu University

Professor Akira Omoto, Japan

Introduction

Kyushu University, one of 87 national universities in Japan, has 11 undergraduate schools, 17 graduate schools, 16 faculties, and a hospital.

In this university, there is one unique department, Department of Acoustic Design, which makes a specialty of a wide range of acoustical subjects. This department belongs to the faculty of design which was originally established as independent university, Kyushu Institute of Design (KID), in 1968 toward the principle of “Humanization of Technology.” Due to the restructuring concept of the national universities in Japan, KID was integrated with Kyushu University in 2003. In the Department of Acoustic Design, the number of regular students for the undergraduate course is 38 per year, and 20 to 30 for the graduate course. The program is conducted by 19 academic staff members.

Educational Aims of the Department of Acoustic Design

The department trains its students as specialists in acoustical design by providing them not only with a technical understanding of acoustics and the art of its application but with a broad perspective on man and his society. To this end, the department’s research focuses on planning and design which deepens our understanding of the culture of sound, creates acoustic environments appropriate for human beings, and promotes advances in the content and quality of acoustic information.

Curriculum

Students have two-years for general education. However in the Department of Acoustic Design, there are some specialized subjects during these years. Based on the educational aim shown above, the subjects cover very wide range of acoustics, e.g., musical acoustics, physiology and psychology of hearing, noise control engineering, and signal processing. All of the specialized subjects are listed below.

Year 1	
1st Term	2nd Term
Seminar in Sound Culture I, II	History of Western Music
Tech. Listening Training I	Theoretical Acoustics I

Year 2	
1st Term	2nd Term
Sound Design	Psychology of Hearing
Physiology of Hearing	Digital Signal Processing
Acoustical Information Processing	Construction of Music
Electrical Engineering	Electronics
Theoretical Acoustics II	Phonetics
Instruments Practice	Sound Performance
Linguistics	Comparative Musical Theory
Tech. Listening Training II	Practical Application of Theoretical Acoustics
Programming Languages	
Perceptual Psychology	

Year 3	
1st Term	2nd Term
Experiments on Electronics	Acoustics Laboratory II
Acoustics Laboratory I	Nonlinear Dynamics
Psychometrics	Applied Musicology
Musicology	Acoustics of Musical Instruments
Room Acoustics	Acoustic Information Processing Seminar
Rating and Control of Noise	Oral Examination concerning important keywords of acoustics (around 100 keywords)
Theoretical Analysis of Sound Field	
Auditory Perception and Cognition	
Audio Devices	
Digital Signal Processing Seminar	
Acoustic Information Processing	
Audiology	

Year 4	
1st Term	2nd Term
Seminar	Senior Project II
Sound Recording and Creation	For graduation, in addition to 136 credits which include 80 credits for specialized subjects, students are required to complete a graduation thesis
Senior Project I	
<i>Awarded degree:</i> Bachelor of Design	

Student Selection

To enter the Department of Acoustic Design, a student must take common and individual examinations which include physics and mathematics covering highest contents for high school as usual scientific universities in Japan.

Careers of Graduates

About half of the undergraduate students go to the graduate course (master course) and the remaining are employed by companies. The career of both undergraduate and graduate students can be summarized as below (roughly in the descending order).

- *Manufacturing industry:* including SONY, Panasonic, Toshiba, Hitachi, Yamaha, Roland, Kawai, Bose, DENON ...
- *Information and Communication Technology:* NTT, Trendmicro, Software division of Fujitsu, NEC, IBM, ...
- *Noise Control Engineering:* Private Consultant, General Contractor, Car industry such as Kajima, Shimizu, Nissan, Honda, Toyota, Mitsubishi, Daihatsu, Suzuki...
- *Broadcasting:* NHK, TBS, YTV, ...
- *Sound Engineer:* Recording Studios, ...
- *University Staff:* mostly in Japan

Around 10 percent of the students go to the field of noise control engineering every year (an average of 3.6 students per year over 30 years).

Summary

The staffs of the department are still trying to improve the curriculum to adapt the drastic changes of the society. However, needless to say, these changes are not only chasing the trend, but holding the physical and mathematical basics of the acoustics.

Noise Control and Acoustics Education at the NOVIC Center in KAIST

Prof. Jeong-Guon Ih, Korea

Background Information about KAIST and NOVIC:

The Korea Advanced Institute of Science and Technology (KAIST) is a government-built, higher-education institution offering B.S., M.S., and Ph.D. degrees in science and technology. It is a research-oriented university, so the total number of postgraduate students far

outnumbers the number of undergraduate students. The undergraduate students are mostly from special "Science Highs" and "High Schools for Gifted Students," into which only a small fraction of all high school students in Korea can enter. The Center for Noise and Vibration Control (NOVIC) was founded in 1989; it encompasses six regular academic staffs and five adjunct staffs from the Mechanical Engineering and Architectural Acoustics departments, and about 130 postgraduate students and post docs. By August, 2008, NOVIC had produced about 320 M.S. and 220 Ph.D. graduates; most of the Ph.D. graduates are now working at research institutes and industry in Korea.

Key Question:

Is specialized training leading to an academic degree needed for the practice of noise control engineering in your country?

Answer: Absolutely yes. But, there is another way to be a certified noise and vibration engineer and that is by taking a qualifying exam.

Capacity:

- What is the current capacity of your institution for producing trained noise control engineers? How many students can the noise control engineering program at your university accommodate and how many graduate annually?

Answer: On average, we produce about 33 engineers per year.

- Does this number satisfy the current demand for noise control engineers?
Answer: We enjoy a surplus of industrial demand. Industry fields in Korea that request high-level noise and vibration control engineers are: car manufacturers and their part makers, electronics companies, heavy industries, ship-building companies, train manufacturers, defense industries, construction companies, steel and metals manufacturers, etc. Also, many graduates are employed by the research institutions and educational institutions.

Curriculum:

- At your university what are the essential courses of a curriculum to educate students in noise control engineering?
Answer: (B.S. level) Mechanical vibrations, Dynamics; (M.S. and Ph.D. level) Introduction to acoustics, Linear vibrations, Noise control, Random data, Linear system control, Rotor dynamics, Computational vibration analysis, Mechanical signature, Wave propagation, Structure-borne sound, Aeroacoustics, Vehicle NVH (excluding mathematical courses and core courses).

- When does a student at your institution begin this curriculum (e.g. fourth year of university)?

Answer: Third year of university, usually in postgraduate school.

- What department in your institution offers this curriculum, and what degree is awarded at its completion?

Answer: M.E. and A.E. M.S. or Ph.D. is awarded.

- How many years does it take on average to complete this curriculum?
Answer: For M.S. it takes one year and for Ph.D., two years for the course work only.

- Is a thesis required for this degree?

Answer: Yes, for all students.

- Identify the components of a particular curriculum in noise control engineering as related to its subspecialties, including the design of low-noise products, building acoustics, and measurement and instrumentation technology (Include a model curriculum.).

Answer: Noise control, Rotor dynamics, Structure-borne sound, Aeroacoustics, Vehicle NVH, etc.

Preparation:

- What is the mathematical level required of students entering this curriculum (describe in detail)?

Answer: At the undergraduate level, differentiation and integration theory I and II, applied differential equations,

engineering mathematics I and II, linear algebra, applied analytical methods, and numerical techniques. At the postgraduate level, mathematics for mechanical engineers, introduction to FEM, introduction to BEM, variational and energy methods, optimal design, etc.

- What background courses do engineers need in the psychological, physiological, and social sciences?
Answer: Several courses among the usual human science courses are required for the undergraduate students. Special topics in psychology are studied only for the students who specialize in sound quality or spatial sound.

Support:

- What are the sources of financial support for your students and for the research projects they carry out under your supervision?
Answer: Basically, all students receive full scholarships from either government or industry. Tuition and fees are provided with some amount of living cost as well. Additionally, if a student is involved in a research project, he or she will be provided further financial support from the supervisor. Funded research projects from government and industry have a ratio of about 2.5:1 in terms of the amount of research money.

Short Courses and Distance Learning:

- For those noise control practitioners without formal training in noise control engineering, what professional development opportunities exist in your institution to provide knowledge of the fundamentals of the field?
Answer: At the moment, we provide two short courses every year. (1) Modal Analysis: Theory, test, and applications (since 1983, annually; trained about 1,300 engineers) and (2) Noise Control: Fundamentals of Acoustics and its applications (since 1991, annually; trained about 820 engineers). Participants were mostly

from industry in Korea.

- What fraction of the noise control practitioners in your country are prepared for practice using primarily these opportunities?
Answer: We do not have any statistical data on the number of noise control engineers in Korea, but the number of trained engineers in the two aforementioned courses indicates that about 95 noise control practitioners per year are taking these educational opportunities from our center. Most of Korea's major industries send their engineers here for these short courses.

Discussion – Session 1

Chair: Few students find jobs in noise control engineering. Is this because the students are not interested in noise control or the companies and government ministries are not interested?

Prof. Qiu: For the students in Nanjing University, when they graduate if they are not going into the post-graduate program, almost everyone can get a job. However, few find a job doing noise control. The reason might be that normally the company doing noise control engineering pays less than the banking and financial industry and the electronics companies.

Chair: Panel, are there engineers in industry who have not taken a course in acoustics? Engineers doing noise control without training?

Prof. Qiu: From projects we have carried out and from my experience, many engineers in industry are doing noise and vibration control. Many of them lack the knowledge we are teaching. For example, in car manufacturing companies and commercial production companies, there are many problems with noise and vibration control; but these come from different departments such as

quality control. The engineers in these departments sometimes have not taken courses in acoustics and vibration control.

Prof. Omoto: It is almost the same in Japan. There are some engineers without acoustics or noise control training. They are mechanical engineers or electronics engineers or sometimes other engineering specialties. Our department offers special courses in acoustics.

Prof. Ih: In Korea, there are many experts in industry who are educated in noise and vibration control. The demand for experts is high because industry has only engineers with the basics of noise control or acoustic technology. Nowadays, what is requested is a higher and specialized level of technology training. Fulfilling industry demand is very difficult as the products become high-end and the requested training becomes specific to an industrial field. But still we have some requests for graduates with this training from small and medium-sized companies. They have a limited knowledge of acoustics and noise control, so the training we provide seems to be quite helpful to them.

Prof. Qiu: Nanjing University is the only university in China which provides a bachelor's degree in acoustics. All graduates can get a job or go on to a postgraduate program. Both industry and government ask us to enroll more students, but we don't have the ability to do that. We need to apply to the Ministry of Education for more funding so we have the capability for more students.

Chair: This question is for KAIST. Are graduates in research ministries and industry doing noise control engineering or general acoustics such as room acoustics or building acoustics?

Prof. Ih: The graduates have a variety of specialties. Some students study architectural acoustics, for example; but the number is very small. Usually they study only general acoustics or noise control.

If they join industry, they are usually assigned to job positions that are strongly related to their former study or training. But, after they are promoted to a higher position, they usually go into other areas. When he or she becomes a manager, the job function becomes different from his/her specialization—usually a systems engineer with only a small part involved with noise and vibration control.

Prof. Eun: When you say the noise control industry, do you mean specifically major industry or small companies such as consulting companies? When Prof. Qiu says industries, he means big companies which deal with noise control engineering as part of their business. So it should be distinguished which one is meant—a small-scale consulting firm or a major industry?

Prof. Qiu: There are two kinds of companies in China. We have small consulting companies involved with noise and vibration control. Large companies such as a car manufacturer have departments doing design related to acoustic noise and vibration control. What I talked about in my presentation was pertinent to the small companies. Actually few graduates want to go to small companies. Most graduates would like a job in a large company in China that normally doesn't have a division or department especially for noise and vibration control. The company may have a department, for example, on quality control, which does projects related to noise and vibration control.

Chair: Are jobs in larger companies more attractive than those in smaller companies as far as engineers are concerned?

Prof. Qiu: Yes, I think so. When they're working in small companies, sometimes they get a high salary, sometimes very low. The average salary in a small company is usually lower than that in a large company.

Chair: In China, Japan, and Korea, what is the extent to which government bureaus employ your graduates? In China, are government bureaus attractive for your graduates as far as noise control engineering is concerned?

Prof. Qiu: Yes. The government bureaus want to employ our students and most of our graduates also like to go into a government department because the job is very stable and the salary is not low.

Prof. Omoto: Quite a few Kyushu University graduates go to government jobs, and many go to commercial companies or private practice.

Prof. Ih: After graduation, some students become government officials, but not many. To become a government official, they must take a special examination which has nothing to do with their specialties. If a graduate wanted to practice his/her own specialty, he/she should try to get a special contract with the government. But nowadays something like bio- or nano-technologies is preferred, so noise control engineering is probably not as attractive as before.

Chair: I'd like to talk about research funding in Japan. What percent of the funding in acoustics influences the choice of a university? What percent of your research comes from the public and what percent from the private sector?

Prof. Omoto: For instruction, it's completely from school tuitions. For the individual research projects, it's half—half from the universities and half from the private companies. That may not be accurate, but my impression is half or maybe a bit more from the private sector.

Prof. Qiu: For the research funding we get, one third to one half is from the government and the rest is from industry. Very little funding comes from noise and vibration control companies. We do, however, get funding from

telecommunication companies.

Prof. Bernhard: A question for Prof. Qiu from Nanjing. The programming you describe in your university is primarily an electro-acoustics program that offers the possibility for a student to emphasize noise control engineering. But most of your grads are really doing electro-acoustics. Nanjing is a very prestigious university with a very prestigious program. I know we'll hear more about other education programs in China for noise control engineering, but would you make some comments on what you know about noise control engineering at other universities around the country. Particularly address some of the questions we've been asking here about supply and demand and education programs. Please give us a bit of perspective on the differences there might be between Nanjing and other Chinese universities.

Prof. Qiu: This afternoon Prof. Mao from Tongji University will talk about the engineering universities which are teaching noise and vibration courses in China. Nanjing University students normally go to post-graduate programs. Some of our graduates go to engineering universities where they will get their training from an engineering department so they have broader knowledge. For noise and vibration control programs, various departments in many universities in China offer this kind of training. These may be in the environmental engineering department, the mechanical engineering department, or in other departments. The main difference between the noise control engineering program in Nanjing University and the other Chinese universities is that the course in Nanjing University requires intensive math derivations and more physics understanding and we require our students to know the physical basis for the noise control equations and measures in addition to knowing how to use them.

Prof. Tachibana: In this morning's session we have three very special cases.

Prof. Omoto's department is, perhaps, the only department of acoustics in Japan. Nanjing University and KAIST are in the same situation. In this afternoon's session we will have general introductions to the universities in each country. I'm deeply impressed that the universities we've heard from have very enriched contents in their classes on acoustics.

Session 2

Panelists

- **Prof. Dongxing Mao**, Institute of Acoustics, Tongji University, China
- **Prof. C. M. Mak**, Hong Kong Polytechnic, Hong Kong
- **Prof. Kentaro Nakamura**, Tokyo Institute of Technology, Japan

Presentations

Noise Control Education in a Typical Chinese Polytechnic University

Professor Dongxing Mao, China

Tongji University offers NCE programs in the following schools and departments; the number of students graduating and their degrees are indicated:

- School of Transportation (B.Eng., 20-30 students; M.Eng., 2-3 students; Ph.D, 1 student)
- School of Architecture and City Planning (B.Eng., 30-40 students)
- Department of Physics (Bsc., 15-20 students)
- School of Environmental Science and Engineering (B.Eng., 50-60 students; M.Eng., 30-40 students)
- School of Automotive Engineering (B.Eng., 30-40 students; M.Eng., 2-3 students; Ph.D, 1 student)

These schools and department support within the university the Institute of Acoustics which also offers M.Eng. degrees with 10-15 students and Ph.D degrees with 3-5 students. At Tongji

University the average student requires 4 years for a B.Eng./Bsc., and an additional 2.5 years for a M.Eng./Msc., or 3 years for a Ph.D.

NCE Education Research Facilities at Tongji include a reverberation chamber (286m³), an anechoic chamber (1200m³), an automotive NVH chamber, three wind tunnels (two for structural engineering and one for automotive NVH), a high-speed flow test stand, a noise response listening room, and a full-sized, rail-noise test track.

Curriculum of NCE program Department of Physics

- Essential courses: Advanced mathematics (2 semesters), Physics—general and mechanics (4 semesters), Analog/digital circuit (1 semester), Electronics (1 semester), Mathematical physics (1 semester),
- NCE Professional courses: (starting from 3rd year)
 - Fundamentals of acoustics (1 semester),
 - Noise control engineering

(1 semester),

- Acoustical measurements (1 semester),
- Graduate thesis: (1 semester)

Institute of Acoustics

NCE Professional courses:

- Advanced noise and vibration (1 semester),
- Theoretical acoustics I & II (2 semesters),
- Progress in acoustics (1 semester),
- Acoustical measurements (1 semester),
- Digital signal processing (1 semester),
- Environmental noise assessment and prediction
- Noise and vibration control
- Research practice
- Graduate thesis: (3 semesters)

School of Environmental/Automotive/Transportation

- Essential courses: Advanced mathematics (2 semesters), General physics (2 semesters), Theoretical mechanics (1 semester), Material mechanics (1 semester)

Model Curriculum – Environmental Acoustics (R: Required; E: Elective)

Professional Courses	Hours	Credits	R or E
Advanced Acoustics	54	3	R
Advanced Acoustical Experiments	54	3	R
Signal Processing	54	3	R
Professional Foreign Language	36	2	R
Theoretical Acoustics	36	2	R
Acoustic Transducers	36	2	R
Noise and Vibration Control	54	3	E
Room Acoustics	54	3	E
C/C++ Programming Language	54	3	E
Lectures on Acoustical Progress		1	R
Literature reading and surveying		1	R

Background Courses

Courses for all Master Candidates	Hours	Credits	R or E
Introduction to Dialectics of Nature	54	3	R
Theory and Practice of Scientific Socialism	36	1	R
Foreign Language (e.g. English)	108	3	R
2nd Foreign language (e.g. Japanese, German)	54	3	R
Teaching Practice or Specialty Practice	36	2	R

- NCE Professional courses: (from 3rd year)
 - Noise control engineering
 - Noise and vibration measurement
 - Field practice (in summer short semester, 1 full week)
- Thesis required but not necessarily in NCE

Mathematics Level System

The requirements on mathematical preparation for the NCE courses are in four levels: mathematics (1), physics (2), engineering (3), and others (4) according to difficulty. Level 1 is for mathematics department students, which is the most difficult level, and level 4 is the easiest level. Levels 2 and 3 include calculus and ordinary differential equations, series solutions and special functions, vector and tensor analysis, partial differential equations, complex variables, and linear algebra.

Supplementary Training

- *Continuing education through distance learning.* Annually approximately 15 students are enrolled. The courses are the same as the regular courses, but the exams are easier. The normal four-year program is extended to five years. Requirement for admission: graduation from a professional college (two years study after high school). In addition to the distance learning opportunity, three-week intensified courses with examinations are available.
- *Financial support.* For students, support may come from research assistant/teaching assistant appointments, consulting firms, and/or parents. For research projects, support may come from research foundations, industry, and governmental support.

National Certification System for Noise Control Engineers

Graduates may become registered engineers in Environmental (Noise) Assessment or Environmental (Noise) Protection. To be certified as a noise control engineer, a student must take

the examination given each year which includes the following subjects:

- *Fundamentals:* Advanced mathematics, general physics, general chemistry, theoretical mechanics, material mechanics, fluid mechanics, computer-related technologies, electrical engineering;
- *Professional (NCE):* Noise control engineering, environmental surveys and measurements, environmental assessment and planning, laws and regulations, noise control engineering case study.

Noise Control Engineering Education in Hong Kong

Prof. C. M. Mak, Hong Kong

Background

There is an increasing concern about the living environment and the quality of life in Hong Kong. The process of continuing urbanization has caused various kinds of environmental pollution to our community. Of these kinds of environmental pollution, noise is a key one which has many negative impacts on health, behavior, sleep periods, tasking performance, social attitudes, and many other aspects in our daily life. Therefore there is a demand for noise control in Hong Kong, and specialized training leading to an academic degree is required for the practice of noise control engineering in Hong Kong. However, there are not enough jobs solely for acoustic engineers in Hong Kong. There are two reasons:

First, the demand for trained professionals in noise control engineering or acoustic engineering is not very strong in Hong Kong (supply and demand issue). In building services or environmental engineering, noise control or acoustics is usually a small part compared to other areas in the whole project. For example, compared to the electrical installations, fire and safety engineering, heating, ventilation, air conditioning, indoor air quality or lighting engineering in building services engineering, noise control has not

been paid a great attention.

Secondly, acoustics or noise control is usually related to health, acoustic comfort or acoustic quality and is not about “safety” or “life and death” issues. The public does not pay enough attention to it. It is unlike other subjects closely related to human life and safety, such as electrical installations or fire prevention systems. Although noise in the city has negative impacts on people’s health, behavior, sleep periods and other living qualities, it usually does not cause a serious injury or death to people.

Noise Control Engineering Education in Hong Kong:

According to the current situation of supply and demand, no bachelor degrees in noise control engineering or acoustics are offered by institutions in Hong Kong. However, there are subjects within a degree course or short courses offered by tertiary education institutions or societies.

Different kinds of higher education opportunities and corresponding curricula are offered on noise control engineering and closely-related subjects in various universities and institutions in Hong Kong. These subjects can cover a wide range of acoustics fields and meet the needs of students at various levels, which include fundamentals of noise, noise assessment, building acoustics, environmental acoustics, sound and vibration control, and so on. Detailed information regarding noise control education in Hong Kong is shown in Table 1 (page 84).

Education in Acoustical Engineering at Japanese Universities

Professor Kentaro Nakamura, Japan

Background

We have nearly 750 universities in Japan, composed of 87 national universities, 89 public universities and approximately 570 private universities. Approximately 600,000 freshmen entered the universities this year.

Table 1, Noise Control Engineering Education in Hong Kong

Institution	Name of Program	Subject Title
Hong Kong Polytechnic University	B.Eng. in B.S.E.	Acoustics Control Engineering
	M.Sc. in B.S.E	Building Acoustics
	B.Eng. in M.E.	Environment Noise
		Noise Abatement & Control
		Principles of Sound & Vibration
BEng in CE	Air & Noise Pollution Studies	
City University of Hong Kong	B.Sc. in E.S.M.	Principles of Noise Pollution
The University of Hong Kong	B.Eng. in ME	Acoustics
		Vibration
	B.Eng. in M.E./B.S.E.	Acoustics
		Vibration
Hong Kong Institute of Acoustics	Short Course	Certificate Course on Road Traffic Noise Assessment
		Certificate Course on Road Traffic Noise Measurement
		Advanced Level Course on Road Traffic Noise Measurement
The Hong Kong Institute of Vocational Education	Higher Diploma in M.E.	Engineering Solutions To Pollution
		Industrial Environmental Technology
Note: BSE-Building Services Engineering, ME-Mechanical Engineering, CE-Civil Engineering, ESM-Environmental Science & Management.		

However, the number of freshmen has decreased year by year for the past five years because of the falling birthrate. At the same time, the number of young people who want an education in the field of science or engineering is also decreasing rapidly. This situation is casting a shadow over education at Japanese universities.

Restructuring of the national universities has been undertaken during the past several years. All the national universities in Japan have changed their organization to a “national university corporation” from a “pure” national university. Some of the national universities were combined, and the total number of the national universities was reduced from 101 to 87.

From the Surveys of The Acoustical Society of Japan

The Acoustical Society of Japan (ASJ) made surveys on education in acoustical engineering at Japanese universities in

1987 and 1999. In addition, a third survey is being carried out this year (2008).

According to these surveys, this report summarizes today’s status of education in acoustical engineering at Japanese universities.

- Half of the participants in the annual meeting of ASJ are engaged in noise control engineering.
- 75 percent of the universities have lectures on acoustics or acoustics-related subjects.
- Education in acoustics is given in departments of mechanics, electronics/information engineering, and architecture/civil engineering as well as in music colleges in Japan.
- In the departments of mechanics, discrete vibration systems is the main topic. Vibration of solid body and numerical methods such as finite element analysis are taught in some of the advanced courses.
- In the department of electronics/information, electroacoustics is

the main subject. The principles of transducers are taught here. Signal processing is also an important subject.

- Room acoustics and psychological methods are dealt with in the departments of architecture/civil engineering.
- In music colleges, some of the basic concepts in acoustics are taught.
- The acousticians in ASJ consider that the most important mathematical knowledge needed to learn noise control engineering is statistics. Basic analysis and Fourier theory are also significant subjects.
- Knowledge of basic physics, electronics, and computer programming are the first three subjects to be studied for noise control engineering.

Web learning

The Japan Science and Technology Agency (JST) is providing an ‘e-learning’ program for free-access. This program contains noise control engineering. Some universities have Open Course Ware (OCW) on their web-site.

Financial support for students and for research

Monbu-kagaku-sho (Ministry for education and science) has several financial support programs for students and research. Approximately 191.3 billion yen was supplied under the program of “Promotion of research by Grants-in-Aid for Scientific Research” in 2007. Approximately 25 percent of the applications from researchers pass this selection process every year.

On the other hand, the COE (center of excellence) program provides special support for building a new education system in universities. We have several private foundations for young scientists, such as the “Ono Grant for Sound Science” and “The Sound Technology Promotion Foundation.”

Short courses

INCE/J (Institute of Noise Control

Engineering of Japan) has basic courses for noise control three or four times a year. ASJ (Acoustical Society of Japan) is offering some short courses for various fields in acoustics such as digital signal processing, ASJ-model, ultrasonics, sound source localization, and speech recognition. A summer seminar for young researchers and students has been held every year this past decade. The ASJ has started a beginner's seminar since its last annual meeting.

Summary

- Noise control engineering / acoustics is taught in the departments of mechanics, architecture, and electronics / information.
- The number of lectures related to acoustics is decreasing in undergraduate courses at Japanese universities.
- Several special universities provide a full set of acoustic courses.
- Not many universities have complete courses for acoustics.
- In general, it is difficult to cover all the required subjects at one university.
- The role of academic societies is becoming important to complement the curriculum at universities.

Most of the data presented in this talk were provided by the members of the Research Committee for Education in Acoustics, ASJ.

Discussion – Session 2

Chair: How many students are concentrating on noise control engineering in the Environmental Engineering Department at Tongji University?

Prof. Mao: In the Environmental Engineering Department about one fourth of the students concentrate on noise control engineering. We have four subspecialties, which are water, air, solid

waste, and noise pollution control; and the students are almost evenly distributed in each specialty. Therefore, one quarter of them are studying noise control engineering.

Chair: In Tongji University, you have many undergraduate students studying noise control engineering in the automotive department. Can you get many of these students to continue for a Master's degree in noise control engineering?

Prof. Mao: No. It depends on the interests of the students. Some years we have few automotive students who enter the Master's degree program. Very few students in the automotive department choose noise control engineering as their focus for a Master's degree program as compared to other directions in automotive engineering.

Chair: Will the panelists please comment on the supply and demand for noise control engineers in your countries.

Prof. Mao: In the morning session Prof. Qiu was talking about the demand and supply at Nanjing University. At Tongji University the noise control engineering education was combined with other engineering disciplines such as environmental noise control or automotive noise control. Today in China there is a big demand in the automotive industry, in environmental studies, and also in civil engineering. The demand in these areas is very strong. But the problem is that we can have only a few students who specialize in acoustics, that is, take full courses in noise control. For example, in some automotive companies, when they have an NVH group, they may plan to employ ten members who specialize in noise control engineering. But of all the people they finally get, only one fifth of them will come from institutes where they have had full courses in noise control engineering. Others come from the automotive department and have taken only a part of the noise control engineering

courses. They have to work together because students from the Institute of Acoustics, for example, do not have much knowledge of special engineering fields such as the automotive engineering.

Prof. Mak: Recently we have had a meeting on this subject at the Hong Kong Institute of Acoustics. We discussed the possibility of having a post-graduate diploma or MSC curriculum in acoustical or noise control engineering. However, after our discussion we realized that the demand for such courses is not very high. It would be difficult for us to recruit or admit students, so we dropped that consideration. Basically in Hong Kong the two branches of acoustics that have most people are building acoustics and environmental acoustics, but the numbers are not large. Again it's a matter of supply and demand. We cannot have post-graduate courses because we don't have a sufficient demand for such courses.

Prof. Nakamura: It is rather difficult to answer the question of the balance between the demand and the supply. But most Japanese companies need noise control engineers, but there are not so many people available. If the students study very narrowly, they have little choice of jobs when they go into industry; so they study many subjects. The interesting thing is that when my students graduate from my laboratory, they go to electronics or car companies, saying goodbye to acoustics and sound technology. However, after five years, some of the students contacted me asking about the acoustics. Very few companies hire people who know only about acoustics. In general, acoustics are not considered at the beginning of the design of machines. But once a problem arises, the company starts to look for acousticians. But the supply cannot satisfy the demand.

Prof. Tachibana: I'd like to supplement Prof. Nakamura's comment. In Japan, for example, Nissan automobile company

has its own acoustic course for younger engineers for one week—5 days—with rich technical content. So the industry doesn't expect us to provide this additional instruction.

Chair: In the Acoustical Society of Japan summer education program, how do you “tune” the level of the participants?

Prof. Nakamura: This is also very difficult. Every time we consider the level, we tune to the very beginners, the individuals who have just joined this field. So if they attend our seminar, they receive an overview of acoustics, not every detail. Our seminar is tuned to the very beginners.

Prof. Eun: My question is also related to supply and demand but from a different perspective, not with employment but with the content of education. Prof. Mak, I understand that the main concern with noise control engineering in Hong Kong may be related to transportation problems, either with street noise or aircraft noise. You may not have as many problems with industrial noise. I assume that this may require some special consideration when you formulate the educational curricula for noise control engineering. Am I right?

Prof. Mak: Yes, of course, we need to consider transportation noise. In Hong Kong we have a traffic noise prediction model. We have traffic noise assessment. We have many prediction and measurement methods. The students are, of course, in university with wide choices of courses and subjects, but we don't have a degree curriculum in transportation noise. But we do have courses that enable students to study environmental noise or transportation noise or prediction of low traffic noise. There are also courses in the mechanical and civil engineering departments.

Prof. Mao: In the mechanical engineering department courses are given in vibration control. In our department vibration isolation is taught—when a machine is vibrating, how we can isolate the vibration?

Chair: To what extent does the government employ trained noise control engineers in government service?

Prof. Mao: In environmental engineering the students find service in governmental departments to be desirable. They are interested in working in environmental protection departments in the government, (and the government has had a large demand in recent years because the environmental protection issue has become critical during the rapid development in the past few decades in China). But for other departments, such as the transportation and automotive departments, the governmental service post is not as desirable as industrial jobs, such as working in an automotive company because it pays much more than a government job.

Prof. Mak: In Hong Kong we have the Environmental Protection Department that monitors all transportation noise and environmental noise. So they have people trained to do this.

Chair: Are they expecting to use trained engineers in noise control or are consultants available?

Prof. Mak: Hong Kong is an international city. We can engage people from all over the world, including from China.

Chair: In Japan how attractive is government service?

Prof. Nakamura: Most of the students go into industry. Few enter a national research laboratory or similar groups.

Prof. Tachibana: In Japan we have the Research Institute of the Ministry of the Environment. It is a very large research institute, but has no acousticians.

Session 3

Panelists

- **Prof. Joseph Lai**, Australian Defence Force Academy, Australia
- **Prof. Sang Kyu Park**, Yonsei University, Korea
- **Prof. S. Narayanan**, Indian Institute of Technology, India

Presentations

Noise Control Engineering Education in Australia

Professor Joseph Lai, Australia

- The Australian Acoustical Society was formed in 1964 and has approximately 500 members with specializations in noise and vibration, architectural and building acoustics, and underwater acoustics.
- The Association of Australian Acoustical Consultants was formed in 1976 and includes more than 24 companies and approximately 300 consultants.
- There are 600 to 700 noise control engineers in Australia and more than 90 percent of them are estimated to be engineering or physics graduates.

National Engineering Scene

Thirty-two Australian Universities provide accredited or provisionally accredited engineering degree programs. These are:

- 4-year Bachelor of Engineering degree
- 3-year Bachelor of Technology degree
- 1-year Masters coursework
- 1.5-year Masters by research
- 3-year Ph.D.

Less than 25 percent of the funding for these programs comes from the government. Most funding is through the Higher Education Contribution Scheme (fees/tax) for domestic students and fees for international students.

Enrolment in engineering programs over the ten year period (1996 – 2006) has grown by 25 percent for undergraduates, 128 percent for postgraduates, and 49 percent for students doing research work. Enrolment by international students in the same period has doubled and made up 25 percent of the undergraduates in 2006. Women constitute 14 percent of the engineering students and 4 percent of practicing engineers. Because of these increases, the staff/student ratio has fallen from 1:14 in 1996 to 1:21 in 2006.

Although there are 8,000 graduates at the bachelor level, 3,400 postgraduates, and 845 engineers who have completed research work, this is not adequate to meet the demand. The current shortfall in engineers is reported to be 30,000. The number of domestic commencing engineering students has fallen from 6.1% in 1996 to 5.6% of the total domestic commencing students in 2006. Although the current demand exceeds the supply, this is not a capacity issue.

Capacity

There are approximately 200,000 practicing engineers of whom only 600-700 are noise control engineers/consultants. Although approximately 8,000 engineers graduate each year, they cover a diverse range of disciplines from aeronautical engineering to chemical engineering, civil engineering, electrical, mechanical engineering, materials engineering, software engineering, etc. There is no noise control engineering

undergraduate degree program. There are 32 university engineering schools, but only one third offer acoustics/noise control engineering subjects.

Curriculum

- A General Mechanical Engineering Degree requires the following:
- 4- years
- Thesis project (approx 1/3 of final year)
- Vibration (1 subject, approx 3% of the degree curriculum) taken at Year 2 or 3 as core
- Acoustics/noise control (on average, 1 subject, approx 3% of the degree curriculum) taken at Year 3 or 4 either as core or elective

Curriculum

- Year 1: Mathematics, Computational Methods, Physics, Chemistry, Mechanics
- Year 2: Mathematics, Design, Mechanics of Solids, Fluid Mechanics, Materials, Thermodynamics, Dynamics, Vibration, General Education
- Year 3: Mathematics, Design, Structures, Thermofluids, Control, Management, General Education, Electives
- Year 4: Design, Thermofluids, Control, Electives, Thesis Project

Preparation

To enter an engineering program, students must have completed courses in higher level mathematics (Calculus & Linear Algebra) and physics. There is minimal

necessity for background courses in the psychological, physiological and social sciences.

Support for research projects is generally provided by the Australian Research Council and by industry.

Short Courses and Distance Learning

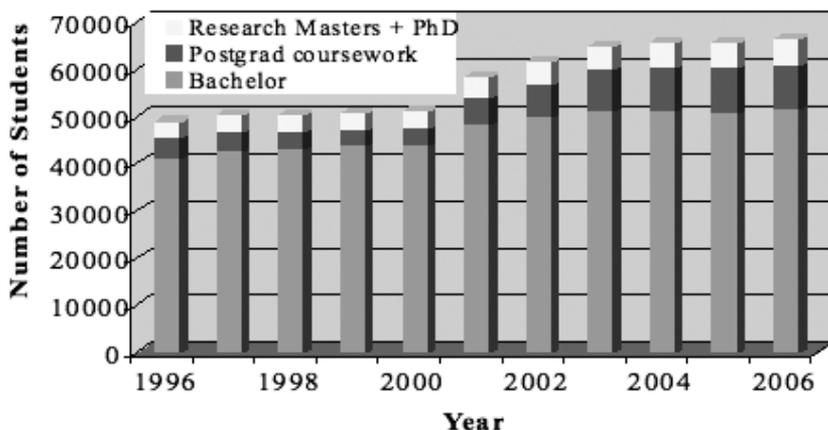
- Noise Control Engineers/Consultants are usually recruited from Engineering/Physics graduates and research student graduates in noise control engineering. The University of New South Wales (UNSW) used to offer Master of Engineering Science in Noise and Vibration but this was discontinued due to low enrolment
- Their professional development is normally supported by:
 - on the job training and mentoring; and
 - a number of short courses ranging from 1 day to 1 week;
- Australian Acoustical Society (AAS)/ Association of Australian Acoustical Consultants (AAAC) Diploma started in 2007:
 - Based on UK Institute of Acoustics Diploma program
 - Flexible professional education in acoustics program
 - Modules: General Principles of Acoustics, Architecture and Building Acoustics, Environmental Acoustics, Noise & Vibration Control, Vibration and Shock, Project

Noise Control Engineering Education in Korea

Professor Sang Kyu Park, Korea

History

The subjects of acoustics and noise control engineering were not taught in most Korean universities until 1970. As the economy expanded in the mid 1970s, people began to take an interest in the noise problem and this resulted in a need for technology to address the problem.



The increase in interest in the field is shown by the rapid growth of the Korean Society of Noise and Vibration Engineers (KSNVE) which, over the past two decades, has increased by 136 members per year—a 30 percent growth rate. The membership increased from 288 in 1990 to 2,505 in 2006.

Membership in KSNVE is classified by occupation as follows:

- Education – 43 percent
- Industrial – 34 percent
- Research – 17 percent
- Machine Design – 2 percent
- Other – 4 percent

Classified by highest degree:

- Bachelor's – 33 percent
- Master's – 32 percent
- Doctorate – 33 percent
- Other – 2 percent

Classified by age the membership is:

- 20s – 12 percent
- 30s – 42 percent
- 40s – 35 percent
- 50s – 9 percent
- 60s – 2 percent

Today the number of Korean high school graduates per year is about 400,000; and of those, about 300,000 continue their schooling. The number of freshmen in pure science and engineering is approximately 100,000. There are 160 four-year universities and 200 two-year colleges in Korea. In addition to the universities which offer degrees in mechanical, architectural, electrical, and environmental engineering, there are other educational opportunities available. These are provided by KSNVE, professional engineering societies, and government organizations.

Traditional Studies

In the Mechanical Engineering and closely related departments, dynamics, vibration and control engineering courses are mainly taught at the undergraduate level, while acoustics and noise control engineering

courses are taught at the graduate level. Mechanical engineering majors are given the opportunity to target their studies towards a number of different specialties including automotive, electronic home appliances, power plant design, petrochemical plant design, environmental plant design (e.g. water treatment, incinerator), and information technology.

In the Aerospace Engineering departments, aircraft vibration control and an understanding of noise generation are taught at the undergraduate level. Aeroacoustics is taught at the graduate level. In the Naval Architecture and Ocean Engineering departments, ship vibration and an understanding of noise generation are taught at the undergraduate level. Noise control engineering, ship structural vibroacoustics, and underwater acoustics are taught at the graduate level.

Students interested in construction-related majors may study architectural engineering where the focus is on auditorium and theater design, construction noise, and interior building noise. Emphasis is placed on exterior design and structural engineering. In the Civil Engineering departments the undergraduates study vibration and blast noise, and the graduate students go on to study wave theory and wave mechanics. In the Electrical Engineering departments the undergraduates study fundamentals of acoustics, and the graduate students go on to study acoustical engineering and signal processing.

Newly-offered Specialties

The curriculum in Environmental Engineering departments has targeted traffic, airport, and railway noise; construction noise; noise policy; and environmental impact assessment.

The curriculum in the departments of Industrial Safety and Health has targeted workplace noise control and related industrial hygiene topics at the undergraduate level.

For education majors, there are courses at both the undergraduate and graduate level. The undergraduates in the departments of Physics Education study the teaching of acoustics, and graduate students in the departments of Science Education continue to study the teaching of acoustics and wave theory. In the colleges of music undergraduates have the opportunity to study an introduction to the acoustics of music.

Continuing Education

KSNVE offers short lectures four times a year on subjects such as mechanical engineering related topics, construction related topics, environmental related topics, information technology related topics, and others.

The Professional Engineers Association offers short lectures twice a year on noise barriers, design of anechoic chambers, absorptive materials, and airport noise. Government bureaus offer courses in noise labeling for construction machinery, noise mapping, “green” growth policy, and Lifestyles of Health and Sustainability (LOHAS).

Noise Control Engineering Education in India

Prof. S. Narayanan, India

Acoustics has been taught in a number of universities in India, usually in the physics departments, for several decades. The main focus is on physical acoustics, wave propagation through layered media, and ultrasonics. Architectural acoustics offers courses in the design of auditoriums, lecture halls, and theaters; room acoustics; acoustic materials; sound absorption, reflection, and reverberation; and Sabine's formulation.

Courses in engineering acoustics and noise control were introduced in the early 1970s mainly in engineering institutions such as the Indian Institute of Technology (in Bangalore, Madras, Delhi, Bombay, Kanpur, Kharagpur,

Gauhati, and Roorkee). These courses are offered to graduate students in mechanical engineering, but the number of students taking the courses is small.

The following courses in acoustics and noise control are taught in three lecture hours per week for 14 to 15 weeks:

- Acoustics and noise control
- Building acoustics & noise control engineering
- Engineering acoustics and its control
- Principles and fundamentals of acoustics
- Noise engineering
- Vibration of marine structures and acoustics
- Aero acoustics
- Engine noise and vibration
- Industrial noise control
- Acoustics of ducts and mufflers
- Structural acoustics

These courses are also taken by Ph.D. scholars doing research in specialized areas of acoustics and noise control.

Course contents - Acoustics and noise control

- Acoustical terminologies and definitions.
- Plane and spherical wave propagation.
- Theories of monopole, dipole and quadrupole sound sources.
- Sound transmission and absorption.
- Mass law transmission, sound transmission through ducts, sound absorption materials.
- Structure borne sound – sound radiation and structural response
- Machinery noise control
- Empirical methods of sound power calculations of bearings, gears, motors, fans, propellers, generators, pump sets, IC engines, gas turbines, etc.
- Noise ratings and standards, human tolerance levels.
- Equivalent sound levels and loudness contours.
- Engine noise and muffler design

Course contents- Industrial noise control

- Principles of sound generation and

propagation

- Sound attenuation, sound absorption
- Sources of industrial noise
- Effects of noise
- Noise measurement units and instruments
- Identification of sources of noise
- Noise evaluation procedures
- Design of acoustical enclosures
- Design of reactive and absorptive mufflers
- Active noise control
- Designing for quieter machines and processes, case studies.

Other topics covered in industrial noise control

- Physiology of human ear
- Subjective response to sound pressure levels
- Hearing damage risk
- Environmental noise criteria
- Mechanisms of noise radiation
- Outdoor sound propagation
- Sound power and sound pressure level estimation procedures

Course contents- Structural acoustics

- Types of wave propagation through solids
- Sound radiation from rectangular plates and cylindrical shells
- Coincidence and wave number spectra
- Wave impedance
- Transform and Rayleigh integral methods
- Effect of fluid loading
- Transmission through partitions
- Fluid structure couplings in waveguides

Course contents- Acoustics of ducts and mufflers (offered at IISc Bangalore)

- Acoustics of moving media
- Analysis and synthesis of one dimensional acoustic filters.
- Exhaust process of reciprocating IC engines
- Analysis and design of exhaust mufflers
- Finite wave analysis of exhaust systems.

- Aeroacoustic characterization of engine sources.

Course contents-Building acoustics and noise control engineering

- Noise and vibration control in buildings
- Sound reinforcement system design
- Acoustical materials
- Reverberation control
- Construction equipment noise
- Criteria for noise and vibration in communities, buildings
- Case studies relating to building acoustics
- Cost effective noise control
- Noise and the law

Course contents – Aeroacoustics

- Governing equations
- Lighthill’s analogy
- Aerodynamic sound in unbounded flows
- FWH equation
- Sound generation in a fluid with rigid and flexible boundaries
- Aeroacoustics of internal flows
- Waves in pipes
- Resonant and unstable systems
- Cavity resonances
- Combustion instabilities

Reference books

- Kinsler and Frey and Coppens and Sanders “Fundamentals of Acoustics”
- Munjal “Acoustics of Ducts and Mufflers”
- Bies and Hanson “Engineering Noise Control”
- Irwin and Graf “Industrial Noise and Vibration Control”
- Beranek, “Noise and Vibration Control”
- Harris, “Handbook of Noise Control”
- Baxa, “Noise Control in Internal Combustion Engines”
- Lord, Gatley, and Eversen, “Noise Control for Engineers”
- Lyon, “Machinery Noise and Diagnostics”
- Magrab “Environmental Noise Control”
- Cremer, Heckl, and Ungar “Structure Borne Sound”

- Junger and Feit “Sound Structures and their Interaction”
- Fahy “Sound and Structural Vibration”
- Goldstein “Aeroacoustics”
- Elliot and Nelson “Active Noise Control”

Continuing education programs in industrial noise control and engineering acoustics are offered to industrial participants and teachers from engineering institutions by faculty from IITs and IISc furthering the cause of noise control education in India. Faculty from IITs and IISc offers consultancies in noise control to the automotive and aerospace industries, and to manufacturers of air-conditioning systems, electrical machinery, transformers, etc. Consultancy is also provided in the design of acoustics and noise laboratories and reverberation and anechoic chambers in these industries.

Ph.D. scholars work on research problems in the development and use of finite element and boundary element techniques for sound transmission and radiation. They also work on sound-structure interaction problems, active methods for noise control, statistical energy analysis, combustion acoustics, and building design using ray acoustics.

Research projects on aircraft noise control; active noise control; underwater acoustics; and sound transmission, radiation, and scattering are sponsored by the Department of Science and Technology, the Department of Space, the Aeronautical Research and Development Board, and the Naval Research Board.

Organizations

- The Facility for Research in Technical Acoustics, established at IISc to carry out research in noise control is a center of excellence in technical acoustics.
- The Acoustical Society of India supports the cause of noise control by organizing an annual symposium on acoustics. Papers on different topics of noise control are presented during the

symposium. Papers are also published in the quarterly, *The Journal of Acoustical Society of India*.

- The Committee on Noise Pollution of Central Pollution Control Board sets noise limits and legislation for industrial products.

Discussion – Session 3

Question 1: Are the curricula in the Asia/Pacific region similar?

Chair: My personal view is there’s a lot of similarity in the curricula that are presented. Can we conclude, then, for Question 1 that the curricula in the Asia/Pacific region have strong similarities?

Question 2: Are these courses taught primarily through lectures, or is experiential learning an important aspect of the curricula?

Chair: Experiential asks if you require the students to have hands-on, laboratory work; or is the learning done primarily by lectures. From the discussion here it’s not clear how much hands-on experience is used in the various countries. Is there a difference?

Prof. Lai: Our students do many projects. They are required to make environmental measurements or room acoustic measurements. They are tenacious and ask to do assignments, so we assign them some measurement work.

Chair: Do you think experiments are a vital part of noise control engineering education?

Prof. Ih: I teach noise control engineering and acoustics-related subjects like vehicle NVH. I usually ask my TA to prepare demonstration sessions during the course. There are several demonstrations for the students,

and students can participate in these experimental demonstrations if they want to. Early in the course, I assign a project for each student or a group of 2 or 3 students. At the end of the course, they must give a presentation. Some students do an experiment for the project. To write a report or thesis, they must consult with active engineers in one or more companies about practical measurement. The industry-supported projects are, of course, directly linked to measurement and calculation.

Prof. Lai: Even in Australia, it depends on the university and whether they have the resources for experiential learning. If a university has the resources, generally we prefer the learning to be hands on. In other words it’s not just lectures. The students have to know how to make measurements and how to observe the precautions for experiments. But very often universities do not have those resources, and therefore they can’t perform experiments. At my university we do have experiments and we do have classroom demonstrations.

Prof. Park: I’m in the Department of Environmental Engineering so the course content is a little different from that of the Mechanical Engineering Department. From the environmental aspects I ask the students to be involved in experiments such as modeling with ray noise software or noise mapping software. The course is about 70 percent lecture and 30 percent experiment. In the experiments, noise modeling is included.

Prof. Mao: I agree with Prof. Lai. In China it depends on the university’s resources. We have experiments for students in our textbooks. But in some of our universities we do not have the facilities so we cannot ask the students to do the experiments. They can only observe the demonstrations. That’s the situation. At our university we have very good resources. We have different measurement facilities including an anechoic-chamber and a reverberation

chamber. For us is easy to assign experiments to the students.

Prof. Mak: In lectures sometimes I ask my research assistant or research student to do a demonstration like bring in the FFT analyzer and impact hammer to demonstrate to the students how to measure formability so that students will understand how we measure formability, transfer mobility, functions like that.

Chair: The answer to Question 2 then is that if the resources are available, it is important for the student to receive some experimental exercises. It really depends on the university resources.

Question 3: What is the proper balance of theory (e.g. acoustics, linear vibrations) and practical matters (e.g. noise measurement, noise control approaches, and legal issues)? Sometimes when those without engineering backgrounds come into the field, the first thing they pay attention to are the practical matters without necessarily having the background in the field to understand what they are doing. So what is the proper balance?

Prof. Omoto: Equal—fifty-fifty.

Chair: The question is not well worded. The question should be oriented to where the student is career wise. If the student is about to graduate and has already received a lot of theoretical background in the field, then it is important he or she receive some practical education on the outside world, including the legal issues.

Dr. Eun: I think Question 3 is all right. I understand the spirit of the question. Given the nature of the noise and vibration problems we encounter in the real world, it is rather difficult to educate and train the real professionals mainly through classroom education. It's a more desirable process to do what I call "starting by working." In a sense it may be better to expect a man to make himself a professional engineer. Self-made. So

in a sense you say half-half, but I say more in the practical matters. I consider my own case. I'm actually a physicist, more specifically I was a physics major, specifically studying wave theory in plasma physics, and that's what made me turn to acoustics. The theory is very similar theory and I practically learned it myself. I started myself by working. I may not say that I'm such a knowledgeable professional, but still I can function reasonably well. I received a lot from school education, but learned the real profession of noise control engineering while working in the practical world.

Chair: What you're saying is that we really need more practical experience.

Dr. Eun: You need theory, basic theory, a certain amount. But we need more practical experience.

Prof. Eagan: My viewpoint is slightly different because at our university we are going to produce an engineer who will work on the development of a product. For the development of the product, if it is a complicated one, the graduate needs knowledge in many areas. We emphasize basic education in the undergraduate school, for example, through mechanics and electronics and things like that. For developing a vacuum cleaner, we need knowledge of many things. So I would say theory should be 67 percent and practical matters 33 percent.

Prof. Mao: Regarding practical matters, our students can set an example for the answer to this question. In my presentation I talked about the MVH groups in the automotive companies. Each group has four students from engineering and one student from pure acoustics. That means that for the engineering students, they are weak in acoustics but more trained in practical matters. After the first year, the companies like the engineering students because they can perform the noise measurement very quickly and are very familiar with the products. But after

one year when asked to dig deeper, they are weak in theory and need from the second year on the support of the students with strong theoretic backgrounds.

Prof. Mak: It's hard to say whether you need more theory or more attention to practical matters. Our Department of Building Services Engineering is a combination of various engineering disciplines—electrical, mechanical, and other fields like management. Because our acoustics course is an elective subject in the final year, we can't teach much theory. So we only teach fundamentals and more important practical cases. That's why it's hard to give a percentage. It really depends on the program we are teaching.

Dr. Eun: When I say the practical matters, I don't mean that you should ignore theory. When starting work, it is up to the individual to study the practical matters.

Chair: How can student interest in the field of noise control engineering be stimulated? The interest today in many universities and institutions is on nanotechnology, bio-engineering, molecular biology, all the hot topics. Noise control engineering is one of the fields that's been around for a while; but as was just pointed, the design of a new product is a complicated matter and the engineer needs a broad background to get involved in product design, if the amount of noise power emitted by the new product is to be minimized.

Prof. Ih: I have a comment. Noise control engineers should study interdisciplinary subjects. If a student studies acoustics and noise control and then goes to a company involved in product development, then he becomes involved with various aspects of design and development. Many students specialize in a particular design aspect, but a noise control engineer should be involved with broader studies. Many of my former students have become product managers; it's very easy to get promoted

because they have been involved in the system, not the component. They may even become patent attorneys after that. There are different opportunities. After they are promoted to product manager, the company may assign them to study abroad or for an MBA, which is very important if they are to be a top manager afterwards.

Prof. Bernhard: Could I change the question slightly? How can faculty interest in noise control engineering be stimulated? I'd like to hear from the faculty members here whether they think that their young colleagues starting in the field will enter noise control engineering or not and how we can actually help to stimulate new faculty into the field. It's important for I-INCE to study this question.

Chair: It's pretty obvious where the demand is for in the field. The difficulty is that noise control engineering doesn't have much appeal to the young academic. It's a more mature field than many of those that are attractive to the young.

Prof. Bernhard: A simpler way to ask the question is: Is noise control engineering valued at your university?

Prof. Lai: The original question is very difficult question to answer. The second question is easier to answer. Is noise control engineering valued in a university? I would rephrase the question. Is noise control engineering valued by the government because in most countries it is driven by government funding? At least in my country, it is not compared with other fields. As the Chair said, noise control engineering is a very mature field compared with all the sexy, hot areas. You can understand why they attract a lot of attention. We are competing in a world where the position of noise control engineering is basically at the industrial level. If we want to stimulate interest of young academics, there must be a source of funding. Whether the funding is coming from industry or from government, if we want to stimulate

interest, we have to lobby. Like Bob said. Lobby our university and lobby the government in terms of funding. But there is a lot of competition.

Chair: But doesn't that come back to public demand? Government is intended to reflect public demand. If there's no demand from the public, government doesn't want to put resources into the field. But if there is strong demand from the public, they will put resources into the field.

Prof. Lai: Yes, I agree. But at the moment the public only demands when they have an environmental issue.

Chair: The expansion of the third runway at Heathrow is a good example. It's a hot environmental issue where 10,000 came out to protest. That is productive because it pushes up to the government level the fact that there is public demand. There will be no significant growth of the field of noise control engineering without public demand.

Prof. Mak: I agree with Prof. Lai. It is really a matter of whether the public is interested. Recently I wrote proposal about sustainable development and part of this involves acoustics. In order to get funding, I need to tie it to sustainable development including energy and other environmental issues. Those interested in environment and energy claim that I'm mostly interested in acoustics, but together it is easier to get funding.

Chair: We've touched on a very important point. We can agree on Question 5 that the answer is yes. The next question relates to the previous discussion. There is a percentage of the population of any country here in the Asia/Pacific or in North America or in Europe disturbed by noise. Those people are not all disturbed by the same noise, and only a small number of them disturbed by noise enough to be willing to take action. What percentage of the population would you say is disturbed either physically in the workplace

by having their hearing impaired or psychologically in their home or recreational environment being disturbed by noise? Would it be accurate to say that the majority of people in the world don't care? That's more than 50 percent. Tell a person in the majority that you're a noise control engineer, they say who cares. That is until they personally have their ox gored, until the kid upstairs turns the audio up at 3 a.m. with inadequate sound isolation between the upstairs living space and downstairs. Then they become convinced that noise is a problem. Some of them become vocal and ask why something isn't done about it. Should we admit that the majority of people—50 percent or more—don't care about noise? What percentage are irritated, disturbed, or injured by noise? Ten percent or forty percent? I know it's a minority, but it's a substantial minority of people who have had interactions where noise was too much in one sense or another. Either human-made noise or noise made by machinery or equipment. Does anyone care to give a percentage of the population that would consider noise control engineering an important endeavor?

Dr. Eun: I believe that it depends on the locals and the country. For example, in Korea there is a government agency that moderates the conflicts caused by environmental problems and they decide the compensation—how much money you should pay. This is not a legal system, but an administrative procedure. According to the statistics, more than 70 percent of the conflicts are related to noise and vibration. The farmers complain that their cattle are harmed due to the construction noise nearby. The apartment dwellers complain about local impact noise, so they sue the contractors. There may not be much of a problem in Australia, which is a big country with only 21 million people, so you may not have a noise problem. But in Korea, a small country with almost 50 million people so concentrated, there is a problem.

Prof. Omoto: It strongly depends on the locality, the local aircraft or road traffic

noise. Don't expect me to guess. I'd say it's around 20 percent. It's a starting point.

Prof. Lai: It's very difficult to answer because when you ask for the percentage—whether people care or not—a lot of people do care, but they put up with it. I grew up in Hong Kong where the Hong Kong airport was right next to a residential area; and of course, people care. But they also care about their livelihood; that is much more important. Nothing was done at the time, but the problem increased to the extent that those people who cared put themselves into action. If you ask what percentage of people care, I agree with you that it is a substantial minority. The percentage of people who care and will do something about it is a very small percentage.

Prof. Tachibana: My feeling is that 100 percent of the people are influenced by noise, but very few are aware of the importance of noise control engineering. They don't know of its existence. Even

the politicians and the people in the bureaucracy are not aware of the existence of noise control. It's a problem.

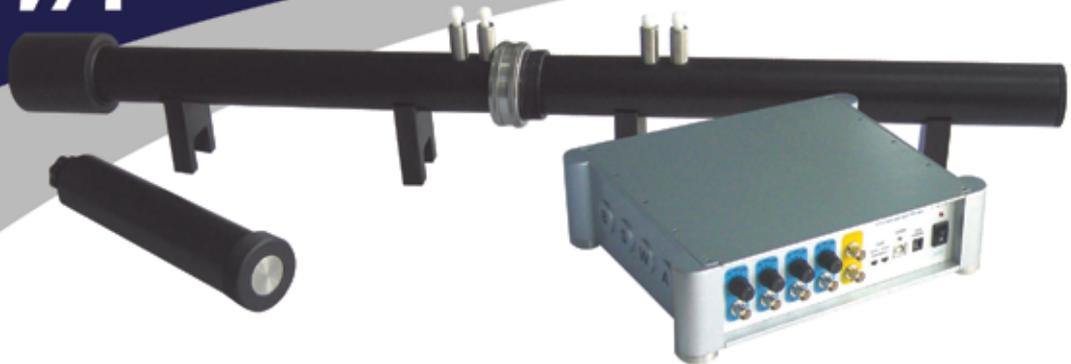
Prof. Bernhard: I'll give two anecdotes that support this. When I talk to people about tire/pavement road noise and reductions, almost uniformly I get the question: You mean something can be done about that? Then I tell them all about how pavements can be made quieter. Almost all of them will say that they wished they would do that in their neighborhood. The second experience was when we did some research on dishwashers. Again, most people thought they had to put up with the dishwasher noise. When I explained what we did and how much quieter we could make it, they would say: I really am annoyed by the dishwasher; I just thought I had to put up with it.

Dr. Maling: We bought a dishwasher recently and you can't tell whether it's on or off when it's washing dishes.

Chair: Because the EU took the leadership role by forcing the publication or availability of data and the market became competitive. You can't go into a white goods store in Europe without being able to find out which of the products is the quietest. It's a cultural problem because the Europeans will not tolerate loud noise from a dishwasher. It's unnecessary, and they know it.

Prof. Tachibana: I teach an acoustics class at the Chiba Institute of Technology, and my feeling is that in the initial stage almost all students are not interested in noise. So I always start by talking about sound and its three aspects. One is information. A second is culture—music. A third is social, social aspects, including noise. We have various aspects of sound, and they become aware of and interested in noise. But after the learning about sound, they become aware of the interest in and necessity for noise control engineering. 

BSWA



Impedance Tubes

- Sound absorption coefficients & material impedance values measurements.
- Sound transmission loss measurements.
- Based on Transfer Function Method



BSWA Technology Co., Ltd.

www.bswa-tech.com

info@bswa-tech.com

USA distributor: Scantek, Inc. / www.Scantekinc.com / 410-290-7726

BSWA Offers Impedance Tubes

SW series Impedance Tubes from BSWA can accurately measure sound absorption coefficients and impedance according to standards described in ISO 10534-2 (1998). They are based on the Transfer Function Method, which is much faster than the commonly used Standing Wave Ratio Method. The Transfer Function Method separates the incident and reflected energy from the measured transfer function, and then estimates the acoustic properties of the tested sample located at the end of the tube. BSWA offers the complete set of Impedance Tube system, which includes: the tubes, microphones; DAQ hardware and measurement software.

BSWA 1/4" microphones MPA416, which have excellent phase matches, is ideal for impedance applications. The microphones are directly connected to optional 2-channel MC3022 or 4-channel MC3242 data acquisition hardware. PA50 power amplifier is used to drive the loud speaker in the impedance tube. The BSWA VA-Lab software provides all measurement functions for sound absorption and transmission loss testing.

Established in 1998, BSWA Technology Co., Ltd. is an acoustical company covering the businesses of:

- Manufacturing the world class measurement microphones.
- Developing acoustic measurement systems and devices.
- Designing and building anechoic chambers.
- Acoustical consulting for environmental and noise control projects.

With headquarters located in Beijing, BSWA currently employed 70 staff with branch offices in Shanghai, Guangzhou, and Chengdu. BSWA's products are distributed in over 40 countries through our sales partners. For further information, contact the company at BSWA

Technology Co., Ltd., Unit 1002-1003, North Ring Center, #18 Yumin Road, Xicheng District, Beijing 100029, China. Tel: +86 10 5128 5118; Fax: 86-10-8225-1626; Email: liuwei@bswa.com.cn Internet: <http://www.bswa-tech.com>

Eckel Issues a New "Products and Systems" Brochure

A full range of acoustic testing and research facilities, test enclosures, and sound control panel systems for commercial, industrial, institutional, recreational, educational, retail, and correctional buildings/operations are described in the 12-page brochure "Products and Systems," issued by Eckel Industries, Inc., Acoustic Division, Cambridge, Massachusetts.

Among the standard and custom products covered are:

- acoustic test and measurement facilities including anechoic, hemi-anechoic, and portable anechoic chambers
- architectural noise control panel systems
- modular noise control enclosures
- audiometric booths, rooms, and suites
- heavy duty silencers.

For more than five decades, Eckel has been a leader in anechoic chamber design innovations, and, in the brochure's section on anechoic chambers, details are given on Eckel's ability to engineer chambers with free fields of virtually any size...from extremely small units suitable for hearing aid calibration through to chambers several stories high for acoustic evaluation of aircraft, automotive, and aerospace vehicles, large transformers, etc.

Also discussed are the several varieties of anechoic wedge designs available. In addition, information is supplied on

SuperSoft Anechoic Panels — compact panel absorbers for enclosure treatment when economic and space considerations make the use of anechoic wedges impractical.

The architectural sound absorbing panels discussed — Eckoustic® Functional Panels (FFPs), Flat Functional Panels (FFPs), Delta-Acoustic Panels (DAPs), Acoustic Lay-in Panels (ALPs), and Eckoustic Correctional Panels (ECPs) — provide simple, effective solutions for reducing background noise in buildings/facilities of all types. These systems allow the desired acoustic environment to be easily achieved both in new construction programs and in renovation projects. Applications include: recreational areas such as gyms and swimming pools, multipurpose rooms, classrooms, auditoriums, wastewater/water treatment plants, broadcast studios, classrooms, libraries and other cultural facilities, religious facilities, restaurants, offices, showrooms, manufacturing spaces, and jails and prisons.

For noise attenuation around machinery and for isolation of personnel in industrial plants from equipment noise, several types of Eckoustic Modular Panel (EMP) Enclosures and TEC Noise Barrier Panels are described. These systems also are ideal for control rooms, sound test rooms, end-of-line test enclosures, and recording/broadcast studios. Also supplied is data on special noise control enclosures (RF shielded rooms, reverberation rooms, and similar), jet engine test cells, and gas turbine silencers, as well as a representative list of clients.

For a free copy of the "Products and Systems" brochure, contact Eckel Industries, Inc., 155 Fawcett Street, Cambridge, MA 02138.
e-mail: eckel@eckelusa.com
Internet: <http://www.eckelusa.com>

PCB® Array Microphones Locate Appliance's True Noise Source

Recently, an array of PCB® Model T130D21 microphones was used to evaluate the noise sources on a vacuum cleaner running at different frequencies. An articulating conformal array and software system not only reduced the setup time for near-field measurements but ultimately identified the true noise sources on the product, both structure and airborne.

It would seem that the source of the noise would be from the vacuum cleaner motor or suction hose, but depending upon the frequency, the results proved that the dirt storage container was the main source of noise at specific frequencies. By redesigning the container, the manufacturer was able to reduce the overall noise of the vacuum cleaner, thus providing their customers a more desirable product.

PCB® Model T130D21 array microphones, with their good phase characteristics, were selected to detect the sound source. Using an array of these microphones minimizes the number of samples needed and thus shortens set-up and test time, saving valuable time and money by running a complex test only once. PCB® array microphones are small, cost effective and are ideal for performing the same type of testing on a variety of products ranging from electric razors to car doors.

PCB® is a global leader in the design and manufacture of force, torque, load, strain, pressure, acoustic and vibration sensors. This instrumentation is used for test, measurement, monitoring, and feedback control requirements in automotive, aerospace, industrial, R&D, military, educational, commercial, and OEM applications. For more information about PCB® visit <http://www.pcb.com>.

The Modal Shop Announces New SmartShaker™ with Integrated Power Amplifier

The Modal Shop, A PCB Group Company, announces the SmartShaker™, a revolutionary innovation in electro-dynamic excitation. The models K2004E01 and K2007E01 are four and seven pound force exciters, respectively, that eliminate the bulk, weight and aggravation of the traditional companion 19 inch rack-mount power amplifiers by integrating solid state power amplifier electronics inside the shaker package. What formerly required over 800 cubic inches of rack space, commonly weighing dozens of pounds, now fits compactly in a 3 x 3 x 0.75 in (7.5 x 7.5 x 1 cm) footprint beneath the shaker. This Integrated Power Amplifier design concept follows the PCB® Piezotronics tradition of simplifying the test and measurement process by integrating the needed electronics, much like the original ICP® accelerometers miniaturized and moved the "charge amplifier" to inside the sensor package. The small overall size (3.6 x 3.5 x 5.3 in (9.1 x 8.9 x 13.5 cm)), weighing just 7 lbs, makes it a new class of portable solution for university test laboratories and benchtop vibration studies. Powered via a small DC power supply, similar to those supplied with your laptop, the SmartShaker can be run directly from any 12-21 VDC supply, making it an ideal companion to today's portable PC based data acquisition market.

The SmartShaker models provide up to 7 pounds pk sine force with a ½ inch stroke covering a broad frequency range up to 11 kHz. They feature extremely rugged suspension systems using carbon fiber composite leaf armature flexures, avoiding the suspension damage common to other mini shakers. Intelligent innovations in the SmartShaker with its integrated power amplifier include: 92% ultra-efficient operation for low power consumption,

multiple gain settings and system "mute" selectable via integrated digital control and Smart monitoring of amplifier clipping, overcurrent or overheating with automatic shutdown. Ergonomic EasyTurn™ handles and a variety of nylon stingers provide for safe and simple shaker/trunnion positioning.

The SmartShaker™ models are the latest members of the full line of electrodynamic exciters and SmartAmplifiers™ from The Modal Shop. Each shaker in the line is delivered as a complete kit with all the needed accessories, trunnion mounting base, cable and a variety of complimentary stinger kits for easy attachment to test articles. Stock product for quick delivery and the Total Customer Satisfaction Guarantee have gained TMS the reputation as the fastest growing manufacturer in the portable shaker market. Visit the shaker family web page (www.modalshop.com/excitation) for a guide to shaker force levels and specifications on the complete vibration excitation product line.

For additional information on these or other services, contact THE MODAL SHOP, INC., 3149 E. Kemper Road Cincinnati, OH 45241-1516, Internet: www.modalshop.com, (800) 860-4867, Fax (513) 458-2172 or e-mail: info@modalshop.com. 

International Representatives

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

ACO Pacific

Hong Kong/China: AP Technology Limited
852 3114 6028 • 852 3114 6038
Apmanli@biznetvigator.com

Hong Kong/China: Gelec(HK) Limited
852-29198383 • 852 2591-0548
alexwu00@hotmail.com

Korea: ABC Trading Co.
+82-2-2226-3161 • +82-2-2226-7383
abctrd@abctrd.com

BSWA

Australia: KINGfDOM PTY LTD
+61 2 9975 3272
kingdom@kingdom.com.au

Australia: Noise Measurement Services
+61 7 3217 2850
bob@noisemeasurement.com.au

Austria: Ing. Wolfgang Fellner GmbH
+43 1 282 53 43
wf@shallmessung.com

Belgium: ABC International Trading B.V.
+31 162520447
nl@abctradings.com

Canada: Soft dB
+1 418 686 0993
contact@softdb.com

Egypt: Elnady Engineering and Agencies
+20 2 23425763
info@elnadycompany.com

Finland: APL Systems Ltd.
+358(0)442199940
Ville.ilves@apl.fi

France: ViaXys
+33 2 38 87 45 35
oliver.blazere@viaxys.com

Germany: ROGA Instruments
+49 (0) 6721 98 44 54
roga@roga-messtechnik.de

India: Welan Technologies
+91 20 25393126
info@welanotechnologies.com

Ireland: Sonitus Systems
+353 01 2542560/+44 020 81236009
enquiries@sonitussystems.com

Israel: Emproco Ltd.
+972 (0) 8 6718187
sales@emproco.com

Italy: Spectra Sri
+39 613321
ecaglio@spectra.it

Korea: SM Instruments Co., Ltd.
+82 42 861 7004
youngkey@smins.co.kr

Serbia: NORTH Point Ltd.
+381 24 62 62 72
gajins@north.rs

Singapore: SHAMA Technologies (S) Pte Ltd.
+65 6776 4006
shamatec@signet.com.sg

South Africa: Vibranalysis Instruments S.A./
+27 118867993 qq • +27 115075823
laurence@vibranalysis.co.za

South America: SMART Tech
+55 11 3168 3388
marcelo@smarttech.com.br

Spain: Anotec Consulting S.L.
+34 916 897 540
nico@anotec.com

Spain: PROTOS Euroconsultores de Ingeniería S.L.
+34 91 747 5891
Kimono.alexio@protos-eci.es

Spain: Uros Ingeniería
+34 91 3329621
Jalon_id@uros.es

Sweden: Acoutronic AB
+46 87 650 280
toby@acoutronic.se

Sweden: Arotate-Consulting AB
+46 708 955150
janos@arotate.com

Sweden: Sound View Instruments
+46 (0) 70 681 79 89
Anders.norborg@soundviewinstr.com

Taiwan: OE SCIENTECH CO., LTD.
+886 -2 25115747
terry@oe.com.tw

Taiwan: Tops Technologies, Inc.
+886 932 068 059
kenlee@topstech.com.tw

Thailand: Geonnoise Instruments Thailand Co. Ltd.
+66 042 342091
info@geonnoise-instruments.com

The Netherlands: ABC International Trading B.V.
+31 162520447
nl@abctradings.com

Turkey: DTA Ltd Sti.
+90 224 280 84 44
Akif.goksa@dt.com.tr

Turkey: VibraTek
+90 0312 479 0302
Ibrahim.Caglayan@vibratek.com.tr

United Kingdom: Sonitus Systems
+353 01 2542560/+44 020 81236009
enquiries@sonitussystems.com

USA: Scantek, Inc.
+1 410 290 7726
PeppinR@scantekinc.com

G.R.A.S.

Australia: ACU-VIB Electronics
02 9680 8133 • 02 9680 8233
info@acu-vib.com.au

Australia: ETMC Technologies (Aust) Pty Ltd
02 9555 1225 • 02 9810 4022
info@etmc.com.au

Austria: LB-acoustics Messgeräte GmbH
+43 1 25 93 444 4400 • +43 1 25 93 444 3400
office@lb-acoustics.at

Austria: Ing. Wolfgang Fellner GmbH
+43 1 282 53 43 • +43 1 280 41 97
fellner@schallmessung.com

Belgium: Akron N.V. - S.A.
+32 16 23 01 03 • +32 16 23 26 96
info@akron.be

Brazil: SIGNALWORKS Com. Imp. Export. Ltda.
+55 11 5501 5310 • +55 11 5505 5682
info@signalworks.com.br

Canada: Novel Dynamics Inc.
+1 519 853 4495 • +1 519 853 3366
metelka@aztec-net.com

Canada: Novel Dynamics Inc.
+1 613 598 0026 • +1 613 598 0019
Stan@noveldynamics.com

Denmark: G.R.A.S. Sound & Vibration
+45 4566 4046 • +45 4566 4047
gras@gras.dk

Finland: NOVOTEK Finland OY
+358 19-871 131 • +358 19-871 1300
info@novotek.fi

Finland: MIP Electronics Oy
+358-9-294 1773 • +358-9-294 7084
jouni.lukkari@mipoy.com

France: 01dB - Metravib
+33 4 7252 4800 • +33 4 7252 4747
florent.perrin@01db-metravib.com

France: OROS France SAS
+33 1 69 91 43 00 • +33 1 69 91 29 40
orosfrance@oros-signal.com

Germany: Bertram Schapal - AVM
+49 (0)6152 56176 • +49 (0)6152 53590
bertram.schapal.AVM@t-online.de

Germany: Schmeisser, Handelsvertretung
+49 8131 8 02 90 • +49 8131 8 02 70
handelsvertretung.schmeisser@t-online.de

Germany: Wölfel Meßsysteme Software GmbH & Co. KG
(+49) 9 31/4 97 08-5 00 • (+49) 9 31/4 97 08-5 90
deckert@woelfel.de or wms@woelfel.de

Greece: Paragon LTD
+30-210-2220008 • +30-210-2220019
paragon1@otenet.gr

Hong Kong: S & V Samford Instruments Ltd
+85 228 339 987 • +85 228 339 913
sales@svsamford.com

Hungary: MEGA KFT
+36 (06) 62 438 214/237 • +36 (06) 62 438 214/237
mega@tvnetwork.hu

India: Adams Technologies Pvt. Limited,
+91 44 28173711, 28171631, 52068668 • +91 44 28172676
ganeshhv@adams-tech.net

India: AIMIL Limited
+91 22 2261 5654/55 • +91 22 2261 7524

India: Structural Solutions Private Limited
+91-40-2763 6433 • +91-40-2763 6435
magaffar@stsols.com

Iran: Khadem Sound & Vibration Technology Ltd.,
+98 (0) 2120 279 95/88 • +98 (0) 2120 27982
KHADem@modares.ac.ir

Italy: S.C.S. Controlli e Sistemi S.R.L.
+39 049 9200 975 • +39 049 9201 239
g.m.amadasi@scs-controlsys.com

Japan: Marubun Corporation
+81 3 3639 9881 • +81 3 5644 7627
tsaito@marubun.co.jp
Japan: Riko Associates
+81 4 5935 6995 • +81 4 5935 6993
yas-riko@mars.dti.ne.jp

Korea: SV Corporation
+82 31 501 4030 • +82 31 501 4032
jjyoo@svdigital.com

Korea: RECTUSON Co., Ltd.
+82 55 231 3333 • +82 55 231 4444
rts@rectuson.com

Korea: SEVIT Tech
+82 2 2617 8740 • +82 2 6091 1310
sevit@sevitkorea.com

Malaysia: INFO-TRAX SDN BHD
+603 4270 6085 • +603 4270 6054
faisal@infotrax.com.my

Mexico: Christensen, S.A.
+52 55 56812379 • +52 55 56556021
christensen@christensen.com.mx

Mexico: Technology Calibration and Sales
+52 55 59906925 or 59906964 • +52 55 55906858
aarellano@tcsrl.com.mx

New Zealand: ECS Ltd
+64 9 279 8833 • +64 9 279 8883
grantm@ecs-ltd.co.nz

Norway: Norsonic A/S
Phone: +47 32 85 89 00
Fax: +47 32 85 22 08
E-mail: sbohn@norsonic.com

P. R. China: Landtop Technologies CO., Ltd
+86 10 6802 5665 • +86 10 6801 8063
info@landtop.com

P. R. China: S & V Samford Instruments Ltd
+85 228 339 987 • +85 228 339 913
E-mail: sales@svsamford.com

Portugal: MRA Instrumentação, S.A.
+351 21 421 7472 • +351 21 421 8188
mra@taguspark.pt

Russia: OCTAVA + Company
+7 (095) 799 90 92 • +7 (095) 799 90 93
info@octava.ru

Singapore: Sound & Vibration Control Pte Ltd
(+65) 64 480 383 • (+65) 62 412 181
wupsj@singnet.com.sg

Singapore: SHAMA Technologies (S) Pte Ltd
+65 776 4006 • +65 773 5056 or +65 776 0592
shama@singnet.com.sg

Spain: ALAVA Ingenieros S. A.
+34 91 567 97 00 • +34 91 570 26 61
alava@alava-ing.es

Sweden: Acoutronic AB
+46 8 765 02 80 • +46 8 731 02 80
acoutronic@acoutronic.se

Switzerland: Norsonic Brechbühl AG
+41 34 431 31 21 • +41 34 431 31 22
Matthias.Brechbuehl@norsonic.ch

Taiwan ROC: IEA Electro Acoustics Co. Ltd.
+886 2 2795 5908 • +886 2 2794 0815
iea888@ms71.hinet.net

Taiwan ROC: Purtek Enterprise Co., Ltd.
+886 2 2756 7581 • +886 2 2756 7582
purtek@ms13.hinet.net

Taiwan ROC: Samwell Testing Inc.
+886 2 2692 1400 • +886 2 2692 1380
samwells@ms48.hinet.net

Taiwan ROC: Systems Access Company Ltd.
+886 2 8792 6266 • +886 2 8792 6265
sac.tw@msa.hinet.net

The Netherlands: AcouTronics B.V.
+31 (0)162 42 44 21 • +31 (0)162 42 56 52
mailbox@acoutronics.nl

Turkey: Bias Mühendislik
+90 216 4745701 • +90 216 4745705
bias@bias.com.tr

Turkey: DTA Design Test Analysis Ltd Sti
+90 224 225 37 41 • +90 224 225 37 42
akif.goksu@dt.com.tr

United Kingdom: AcSoft Ltd.
+44 (0)1296 682 686 • +44 (0)1296 682 860
sales@acsoft.co.uk

United Kingdom: Campbell Associates
+44 (0)1371 871030 • +44 (0)1371 879106
info@campbell-associates.co.uk

USA: G.R.A.S. Sound & Vibration
440 779 0100 • 440 779 4148
sales@gras.us

Scantek, Inc.

Mexico and South America:
CIAAMSA División Acústica
(55) 1054 3209 • (55) 1054 3210
nbenitez@ciaamsa-acustica.com

SoundPLAN LLC

Argentina: Dakar ingenieria acustica
AArentina: Dakar ingenieria acustica
Argentina
+54 11 4865 79 84
Soundplan@dakar-acustica.com.ar

Australia: Marshall Day Acoustics
+61 (0)2 9282 9422; +61 (0)2 9281 3611
rleo@marshallday.com.au

Brazil: GROM Acustica & Automacao
+55 21 263 0792; +55 21 263 9108
comercial@grom.com.br

Canada: Navcon Engineering Network
+1 714 441 3488; +1 714 441 3487
Forschner@navcon.com

China: BSWA Technology Co., Ltd
+86 10 5128 5118; +86 10 8225 1626
congheidong@bswa.com.cn

Czech Republic: SYMOS s.r.o.
+420 220 999 977; +42 257225679
symos@symos.cz

Denmark: SoundPLAN Nord ApS
+45 39 46 12 00; +45 39 46 12 02
jkl@soundplan.dk

Egypt: Elnady Engineering and Agencies
+2 (02) 23420896; +2 (02) 23426977
info@elnadycompany.com

Finland: Sound PLAN Nord
+45 39 46 12 00; +45 39 46 12 02
jkl@soundplan.dk

France: Euphonia
+33 02 40 18 05 18; +33 02 40 19 05 20
contact@euphonia.fr

Germany: Braunstein + Berndt GmbH
+49 7191 91 44 0; +49 7191 91 44 24
bbgmbh@soundplan.de

Greece: Acoustics Hellas
+30 210 6630 333; +30 210 6630 334
info@acoustics.gr

Hungary: VIBROCOMP KFT
+36 1 275 2138
pbite@vibrocomp.hu

India: Foretek Marketing Pvt. Ltd.
+91 80 2525 4706; +91 80 2526 6813
info@foretekin.com

Israel: Labgoods Ltd.
+972 3 6121341; +972 3 6121328
email: ronem@labgoods.com

Italy: Spectra s.r.l.
+39 039 613321; +39 039 61 33235
spectra@spectra.it

Indonesia: SHAMA Technologies (S) Pte Ltd
+65 6776 4006; +65 6776 0592
shama@singnet.com.sg

Japan: ONO SOKKI Co. Ltd.
Consulting Group, SV Development Center,
Technical Headquarters
+81 45 935 3818; +81 45 935 3806
Watanan@onosokki.co.jp

Korea (South): ABC TRADING
+82 2 2226 3161; +82 2 2226 7383
abctrld@abctrld.com

Kuwait: KuwaitGIS
+965 2447733; +965 2456760
info@KuwaitGIS.com

Malaysia: SHAMA Technologies (S) Pte Ltd
+65 6776 4006; +65 6776 0592
shama@singnet.com.sg

Mexico: Ing. Acustica Spectrum sa cv
+55 57 52 85 13; +55 57 52 61 83
acusticaspectrum@prodigy.net.mx

New Zealand: Marshall Day Acoustics
+64 9 379 7822; +64 9 309 35 40
siiri.wilkening@marshallday.co.nz

Norway: SoundPLAN Nord ApS
+45 39 46 12 00; +45 39 46 12 02
jkl@soundplan.dk

Poland: PC++ Software Studio
+48 58 3075224; +48 58 3075224
info@pcplusplus.com.pl

Portugal: AAC Centro de Acustica Aplicada SL
+349 45 298233; +349 45 298261
aac@aacacustica.com

Romania: VIBROCOMP SRL Romania
+40 723 614 524
romania@vibrocomp.com

Russia: Baltic State Technical University
+7 812 7101573; +7 812 2988148
marina_butorina@inbox.ru

Serbia-Montenegro: Dirigent Acoustics D.O.O.
+381 11 763 887; 381 11 763 887
dgdtejan@yahoo.com

Singapore: SHAMA Technologies (S) Pte Ltd
+65 6776 4006; +65 6776 0592
shama@singnet.com.sg

Spain: AAC Centro de Acustica Aplicada SL
+349 45 298233; +349 45 298261
aac@aacacustica.com

Sweden: SP Technical Research Institute of Sweden
+46 10 516 5340; +46 10 513 8381
soundplan@sp.se

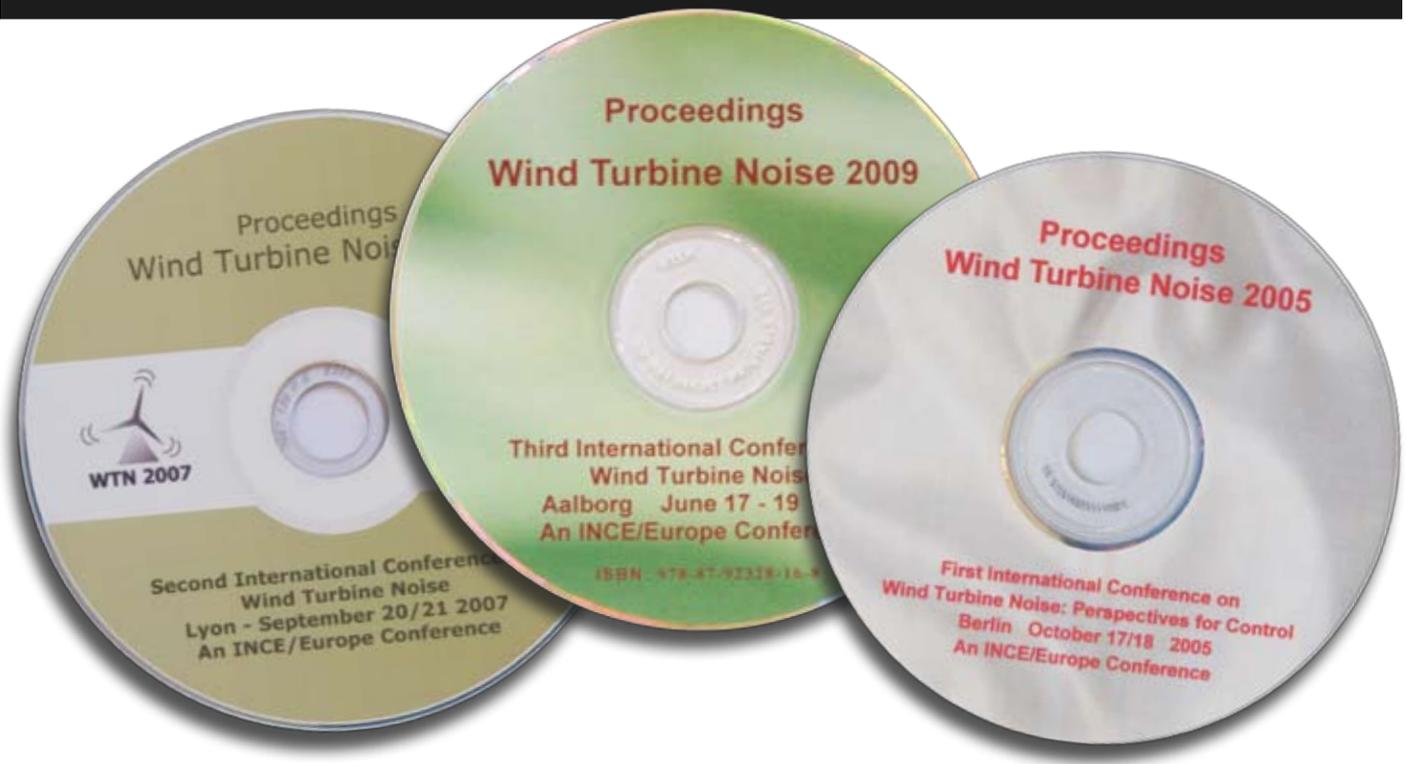
Taiwan: Purtek Enterprise Co Ltd
+886 2 2769 3863; +886 2 2756 7582
purtek@ms13.hinet.net

Turkey: Hid ro-Tek Ltd.Sti
+90 2126598636; +90 2126598639
aakdag@hidro-tek.com.tr

United Kingdom: Technical Development & Investigation
+44 1787 478498; +44 1787 478328
tdi.ltd@btconnect.com

USA: Navcon Engineering Network
+1 714 441 3488; +1 714 441 3487
Forschner@navcon.com

Three Wind Turbine Noise CDs are Available



The race to develop sources of renewable energy has created a great deal of interest in wind turbines. Noise from these machines is a negative factor, and is often a source of complaints from surrounding communities.

The Institute of Noise Control Engineering/Europe (INCE/Europe) has been a leader in the organization of conferences on this subject, and the production of CD-ROMs of the papers presented. To date, three international conferences on wind turbine noise have been held in Europe, and a fourth is planned for 2011:

- **Aalborg, Denmark, June 17–19 2009**
- **Lyon, France, September 20-21, 2007**
- **Berlin, Germany, October 17-18, 2005**

The CD-ROMs from these conferences are now available from INCE/Europe. The price is 55 GBP for one, 95 GBP for two, and 125 GBP for all three CDs.

Contact:

INCE/Europe, Riverside House, 4 Oakland Vale, New Brighton, Merseyside, CH45 1LQ, UK.

Fax: +44 (0) 151 639 5212

E-mail: cathy@cmmsoffice.demon.co.uk

KEY INTERNET URLS:

Order Form

http://www.confweb.org/wtn2011/wtn11docs/order_wtn.doc

Conference web sites

<http://www.windturbine2011.com>

<http://www.confweb.org/wtn2009>

<http://www.confweb.org/wtn2007>

<http://www.confweb.org/wtn2005>

INCE/USA Liaison Program

ACO Pacific, Inc.	Belmont, California
AVAC Continuing Education	Pittsburgh, Pennsylvania
Colin Gordon and Associates.....	San Bruno, California
Acoustical Solutions.....	Richmond, Virginia
Cavanaugh Tocci Associates.....	Sudbury, Massachusetts
G.R.A.S. Sound and Vibration.....	Vedbaek, Denmark
Harris Miller Miller & Hanson Inc	Burlington, Massachusetts
Noise Control Engineering, Inc.....	Billerica, Massachusetts
Overly Door Company.....	Greensburg, Pennsylvania
Scantek, Inc.....	Columbia, Maryland
Vibro-Acoustics.....	Scarborough, Ontario, Canada
Wyle Laboratories.....	Arlington, Virginia

Sustaining Members of International INCE

Acoustic Technologies (A-Tech)	Brussels, Belgium
Brüel & Kjær	Nærum, Denmark
Ecophon.....	Hyllinge, Sweden
G.R.A.S.....	Vedbaek, Denmark
LMS International, NV Numerical Integration Technologies.....	Heverlee, Belgium
Narita International Airport Corporation (NAA)	Narita-City, Japan
Norsonic AS.....	Tranby, Norway
Rion Company, Ltd.	Tokyo, Japan

Institutional Members of International INCE

Argentina.....	Centro de Investigacion en Acustica, Buenos Aires
Belgium.....	Laboratorium voor Akoestiek en Thermische Fysica, Leuven
France	Centre Technique des Industries Mécanique, Senlis
Korea.....	Center for Noise and Vibration Control Engineering, Korean Institute for Science and Technology, Science Town, Taejon-Chi
New Zealand.....	Centre for Sound Studies
Portugal	Laboratorio Nacional de Engenharia Civil, Lisboa
Sweden.....	Department of Applied Acoustics, Chalmers University of Technology, Gothenburg
USA.....	Graduate Program in Acoustics, The Pennsylvania State University, State College, Pennsylvania

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

2010 April 19-21

NOISE-CON 10

Baltimore, Maryland

Joint with the 159th meeting of the Acoustical Society of America.

Contact:

Institute of Noise Control Engineering-USA

Amy Herron, Conference Coordinator

INCE/USA Business Office

9100 Purdue Road, Suite 200

Indianapolis, IN 46268-3165

Telephone: +1 317 735 4063

E-mail: ibo@inceusa.org

2010 June 13-17

INTER-NOISE 10

Lisbon, Portugal

Contact: Portugese Acoustical Society

LNEC

Av. do Brasil 101

1700-066 Lisboa

Facsimile: +351 21 844 30-28

www.spacustica.pt/internoise2010/text/ivitation.html

2011 July 25-27

NOISE-CON 11

Portland, Oregon

Contact:

Institute of Noise Control Engineering-USA

Amy Herron, Conference Coordinator

INCE/USA Business Office

9100 Purdue Road, Suite 200

Indianapolis, IN 46268-3165

Telephone: +1 317 735 4063

E-mail: ibo@inceusa.org

2011 September 4-7

INTER-NOISE 11

Osaka, Japan

Contact: INCE/Japan

c/o Kobayasi Institute of Physical Research

3-20-41 Higashimotomachi, Kokubunji

Tokyo 185-0022

Facsimile: +81 42 327 3847

e-mail: office@ince-j.or.jp

home page: [http://www.mmjp.or.jp/INCE-](http://www.mmjp.or.jp/INCE-JAPAN)

JAPAN

Directory of Noise Control Services

Information on listings in the Directory of Noise Control Services is available from the INCE/USA Business Office, 9100 Purdue Road, Suite 200, Indianapolis, IN 46268-3165. Telephone: +1 317 735 4063; e-mail: ibo@inceusa.org. The price is USD 400 for 4 insertions.

WYLE LABORATORIES, INC.

Research & Consulting

Excellence in acoustics and related specialties since 1961

Offices:

241 18th St. S.
Suite 701
Arlington, VA 22202, USA
Telephone +1 703 415 4550

128 Maryland St.
El Segundo, CA 90245 USA
Telephone +1 310 322 1763

www.wylelabs.com

HESSLER ASSOCIATES, INC.

Serving the Power Industry Since 1976

- Ambient, Diagnostic and Certification Surveys
- Environmental Assessments
- Computer Modeling
- Expert Witness

Hessler Associates, Inc.
3862 Clifton Manor Place, Suite B
Haymarket, Virginia 20169 USA

Phone 1: +1 703-753-2291
Phone 2: +1 703-753-1602
Fax: +1 703-753-1522
e-mail: George@HesslerAssociates.com
Web: www.HesslerNoise.com

Mark your
calendar and plan
to participate!

NOISE-CON 2010

Baltimore, Maryland
April 19-21, 2010

Baltimore, Maryland will be the setting for the 26th annual conference of the Institute of Noise Control Engineering, NOISE-CON 2010. The conference will run concurrently with the first three days of the 159th meeting of the Acoustical Society of America on April 19-23, 2010. A large exposition of noise control instruments and materials for noise control will be held in conjunction with NOISE-CON. There will be one registration fee for both meetings, so NOISE-CON registrants are welcome to stay for the final two days of the ASA meeting. For more details, see the inside front cover of this issue.

SCANTEK, INC.

Sound and Vibration Instrumentation & Engineering

- Sales
- Rentals
- Calibration
 - NVLAP (NIST) Accredited
- Service
- Technical Support

6450 Dobbin Rd. #A
Columbia, MD 21045 USA
Richard J. Peppin
Telephone: +1 410 290 7726
Fax: +1 410 290 9167
Web: www.scantekinc.com
Info@ScantekInc.com

The **Index of Advertisers** contained in this issue is compiled as a service to our readers and advertisers; the publisher is not liable for errors or omissions although every effort is made to ensure its accuracy. Be sure to let our advertisers know you found them through *Noise/News International* magazine.

<i>ACO Pacific, Inc.</i>	75
<i>BSWA</i>	93
<i>G.R.A.S. Sound & Vibration</i>	73
<i>Scantek, Inc.</i>	75
<i>SoundPLAN</i>	73

The INCE/USA Page at the Atlas Bookstore

www.atlasbooks.com/marktplc/00726.htm

INTER-NOISE 06 Proceedings

This searchable CD-ROM contains the 662 papers presented at INTER-NOISE 06, the 2006 Congress and Exposition on Noise Control Engineering. This, the 35th in a series of international congresses on noise control engineering was held in Honolulu, Hawaii, USA on December 3-6, 2006. The theme of the congress was "Engineering a Quieter World."

The technical topics covered at INTER-NOISE 06 included:

- Aircraft and Airport Noise Control
- Community Noise
- Fan noise and aeroacoustics
- Highway, automobile and heavy vehicle noise
- Machinery noise
- Noise policy
- Product noise emissions
- Sound quality.

The NOISE-CON 05 Proceedings Archive (1996-2005)

This searchable CD-ROM contains 198 papers presented at the joint NOISE-CON 05/ASA 150th meeting as well as 749 papers from the NOISE-CON conferences held in 1996, 1997, 1998, 2000, 2001, 2003, and 2004 as well as the papers from the Sound Quality Symposia held in 1998 and 2002. All papers are PDF files.

Several papers are taken from sessions organized by the Noise, Architectural Acoustics and Structural Acoustics Technical committees for this 150th ASA meeting. The three plenary lectures related to noise and its impact on the environment are included. Also included are papers in one or more organized sessions in the areas of aircraft noise, tire/pavement noise, and hospital noise.

Proceedings of Active 2009

ACTIVE 09, the 2009 International Symposium on Active Control of Sound and Vibration, was held in Ottawa, Canada on August 20-22, 2009. It was the seventh in a series of international symposia on this subject.

This searchable CD-ROM contains 690 full length papers on active control of noise and vibration. All papers are in PDF format. The latest in the ACTIVE series of international symposia on active control of sound and vibration was organized by the University of Sherbrooke, Sherbrooke, Canada and held immediately before INTER-NOISE 09. Fifty nine papers from ACTIVE 09 are on this CD-ROM.

The remaining papers are from:

- ACTIVE 06 Adelaide, Australia
- ACTIVE 04, Williamsburg, USA
- ACTIVE 02, Southampton, UK
- ACTIVE 99, Fort Lauderdale, USA
- ACTIVE 97, Budapest, Hungary
- ACTIVE 95, Newport Beach, USA

These papers cover all areas of active control of sound and vibration.

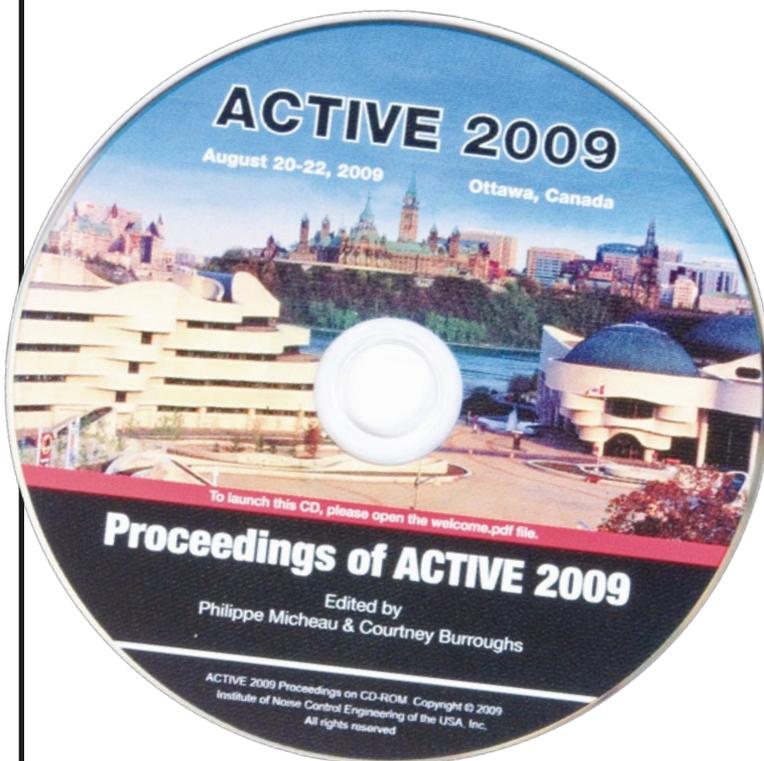
Two indices of the papers presented at ACTIVE 09 are available on the Internet:

Subject Index

<http://www.atlasbooks.com/marktplc/00726active09index.pdf>

Author Index

<http://www.atlasbooks.com/marktplc/00726active09author.pdf>



ACTIVE 09 CD ORDER FORM

Enclosed is my check (or credit card authorization) for _____ U.S. dollars. Please send me _____ copies of the Active 09 CD-ROM at 80 U.S. dollars each. Shipping and handling charge: domestic, 3 U.S. dollars; all other countries, 6 U.S.dollars. Shipped by first class mail in the United States and by air mail to other countries. Stock number: A09.

Name Mr. Ms. Dr. Prof. _____

Address _____

City _____ State/Province _____ Zip/Postal Code _____

Country _____

E-mail _____

Credit card authorization: Visa MasterCard American Express Discover card

Name on card (please print) _____

Card number: _____

Expiration date (MM/YY): _____

Signature _____

You may order by postal mail, telephone (USA and Canada only), by FAX, or by e-mail. Postal mail: Bookmasters, Inc., Distribution Services Division, 30 Amberwood Parkway, Ashland, OH 44805, USA. Telephone: 1 800 247 6553; FAX: 1 419 281 6883; e-mail: order@bookmaster.com. Internet: Go to the INCE/USA page at Bookmasters Atlas Bookstore. <http://www.atlasbooks.com/marktplc/00726.htm>

INTER-NOISE 09 CD-ROM

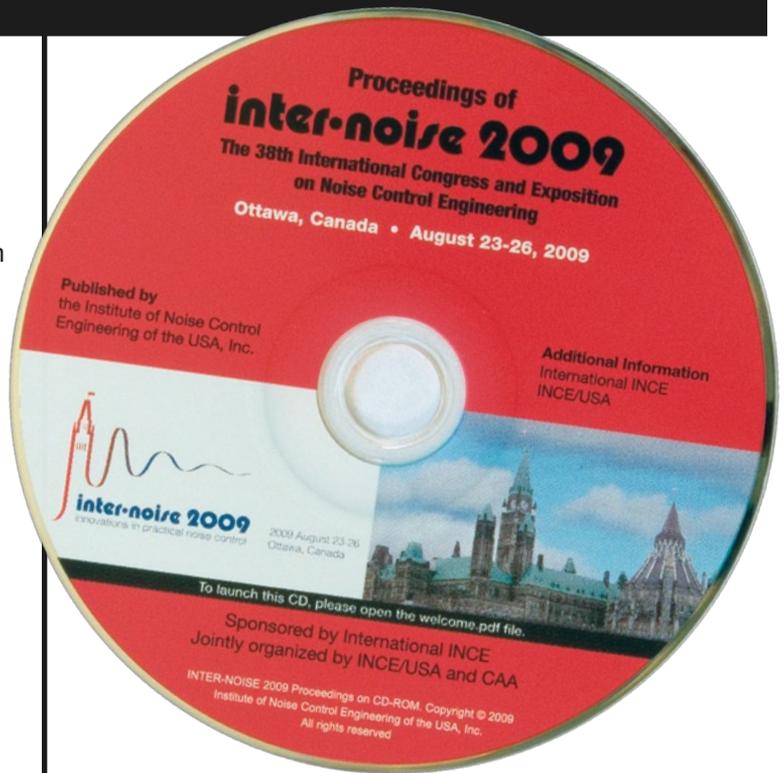
The Proceedings of INTER-NOISE 09, the 2009 International Congress and Exposition on Noise Control Engineering are now available on CD-ROM.

This searchable CD-ROM contains 627 papers. This, the 38th in a series of international congresses on noise control engineering was held in Ottawa, Canada on August 23-26, 2009. The theme of the congress was "Innovations in Practical Noise Control."

The technical topics covered at INTER-NOISE 09 included:

- Aircraft and Airport Noise Control
- Active Noise and Vibration Control
- Building Acoustics
- Community Noise
- Barriers
- Fan noise and aeroacoustics
- Highway, automobile and heavy vehicle noise
- Machinery noise
- Noise policy
- Product noise emissions
- Railway noise
- Sound quality.

These papers are a valuable resource of information on noise control engineering that will be of interest to engineers in industry, acoustical consultants, researchers, government workers, and the academic community.



Two indices of the papers presented at INTER-NOISE 09 are available on the Internet:

Subject Index

<http://www.atlasbooks.com/marktplc/00726internoise09index.pdf>

Author Index

<http://www.atlasbooks.com/marktplc/00726internoise09author.pdf>

INTER-NOISE 09 CD ORDER FORM

Enclosed is my check (or credit card authorization) for _____ U.S. dollars. Please send me _____ copies of the INTER-NOISE 2009 CD-ROM at 80 U.S. dollars each. Shipping and handling charge: domestic, 3 U.S. dollars; all other countries, 6 U.S. dollars. Shipped by first class mail in the United States and by air mail to other countries. Stock number: IN09.

Name Mr. Ms. Dr. Prof. _____

Address _____

City _____ State/Province _____ Zip/Postal Code _____

Country _____

E-mail _____

Credit card authorization: Visa

MasterCard

American Express

Discover card

Name on card (please print) _____

Card number: _____

Expiration date (MM/YY): _____

Signature _____

You may order by postal mail, telephone (USA and Canada only), by FAX, or by e-mail. Postal mail: Bookmasters, Inc., Distribution Services Division, 30 Amberwood Parkway, Ashland, OH 44805, USA. Telephone: 1 800 247 6553; FAX: 1 419 281 6883; e-mail: order@bookmaster.com. Internet: Go to the INCE/USA page at Bookmasters Atlas Bookstore. <http://www.atlasbooks.com/marktplc/00726.htm>