NOISE/NEWS INTERNATIONAL

Volume 28, Number 3
2020 September

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

- New features in SoundPLANnoise 8.2
- The 100th birthday of Jean Mattei
- Tutorial: Time it takes to approach steady state
- NOISE-CON 2020 goes online

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

Volume 28, Number 3 **2020 September**

Features

Departments

Cover image: SoundPLANnoise 8.2 combines environmental data with terrain maps, such as Google Earth, to give you a very realistic picture of how the noise would propagate.

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NOISE/NEWS INTERNATIONAL

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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 blog. I-INCE has an active program of technical initiatives. It currently has fifty-one member societies in forty-six countries.

INCE-USA

The Institute of Noise Control Engineering of the USA (INCE-USA) is a nonprofit professional organization incorporated in Washington, DC, 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 blog. INCE-USA sponsors the NOISE-CON series of national conferences on noise control engineering and the INTER-NOISE Congress when it is held in North America. INCE-USA members are professionals in the field of noise control engineering, and many offer consulting services in noise control. Any persons interested in noise control may become an associate of INCE-USA and receive both this magazine and *Noise Control Engineering Journal*.

NNI and Its Online Supplement

www.noisenewsinternational.net

The PDF and blog versions of *NNI* allow for links to references, articles, abstracts, advertisers, and other sources of additional information. In some cases, the full URL will be given in the text. In other cases, blue text will indicate the presence of a link. The *NNI* blog contains additional information that will be of interest to readers, such as the following:

- The current PDF issue of *NNI* available for free download
- Links to previous PDF issues of *NNI*
- An annual index of issues in PDF format
- A conference calendar for upcoming worldwide meetings
- Links to I-INCE technical activities and I-INCE technical reports

Editor's View

Welcome to the September 2020 issue of *Noise/News International*. In this issue, we learn about some new features in the latest version of SoundPLAN, which includes some new organizational tools as well as the new CNOSSOS-EU noise predictions standards; we celebrate the 100th birthday of Jean Mattei, who was a founding member of INCE/Europe and a board member of I-INCE; and Eric Ungar provides another tutorial, this time focusing on how long it takes a vibrating system to reach a steady state.

We also have an announcement on NOISE-CON 2020 and the plan to hold it as a virtual conference later this year. This follows in the footsteps of INTER-NOISE 2020, which, by now, will have concluded. I hope you had a chance tune in and take full advantage of the online conference. It was a historic event in the life of I-INCE. To mark the occasion, in this issue our From the Archives feature looks back at the last time INTER-NOISE was held in South Korea—back in 2003. And, of course, our December issue will have a full report of this year's e-congress.

I also have some exciting news to share: *Noise/News International* has developed a companion podcast, *The Noise/News*. The first episode is now available on Apple, Spotify, or wherever you get your podcasts. Please be sure to tune in to our first episode, in which I sit down with I-INCE President Bob Bernhard and INCE-USA President Mike Bahtiarian. Bob and Mike provide information on INCE-USA and I-INCE and how COVID-19 has impacted the industry of noise control. It's an exciting development for *NNI*, and I hope you enjoy this and future episodes.

If you have any noise news that you'd like to share on with *Noise/News International*, or even talk about on *The Noise/News*, please don't hesitate to get in touch.

Eoin A. King, PhD

Eoin A. King, PhD

THE

NOISE/NEWS

The Nosie News *is now available wherever you get your podcasts*

NOISE-CON 2020 Moves to Virtual Conference

Gordon Ebbitt
NOISE-CON Conference Chair

The **NOISE-CON 2020** organizing committee is excited to announce that we will be holding a **virtual conference** this year. Our primary goal is to protect the health of NC20 participants. We also expect this will expand conference participation to those who might not normally be able to attend a NOISE-CON. The committee is working out the details, but we would like to share what we know so far:

- The conference will still begin on November 16, 2020. The exact schedule is being determined, but it will likely expand beyond our normal two-and-a-half-day format to fill the entire week, with shorter sessions each day.
- Technical sessions, plenary sessions, networking opportunities, a supplier expo, and many other events are being planned.
- Technical presentations will be archived for a period of time so conference attendees can view them at their convenience.
- As with all NOISE-CON conferences, the conference papers will be published in a proceedings. In addition, all papers will be published in the online INCE digital library.
- Visit the NOISE-CON website for more details on registration, including the online registration fee.
- The paper due date remains September 1, 2020, and the early bird registration deadline is September 22, 2020.

So far, 220 abstracts have been received for NOISE-CON 2020, and we are expecting a very interesting technical program!

As you can imagine, we have a lot of work to do. We will make announcements as the details are confirmed. Please check the **NOISE-CON 20 website** and *Noise/News International* for the latest information.

Biography of Jean Mattei for His 100th Birthday

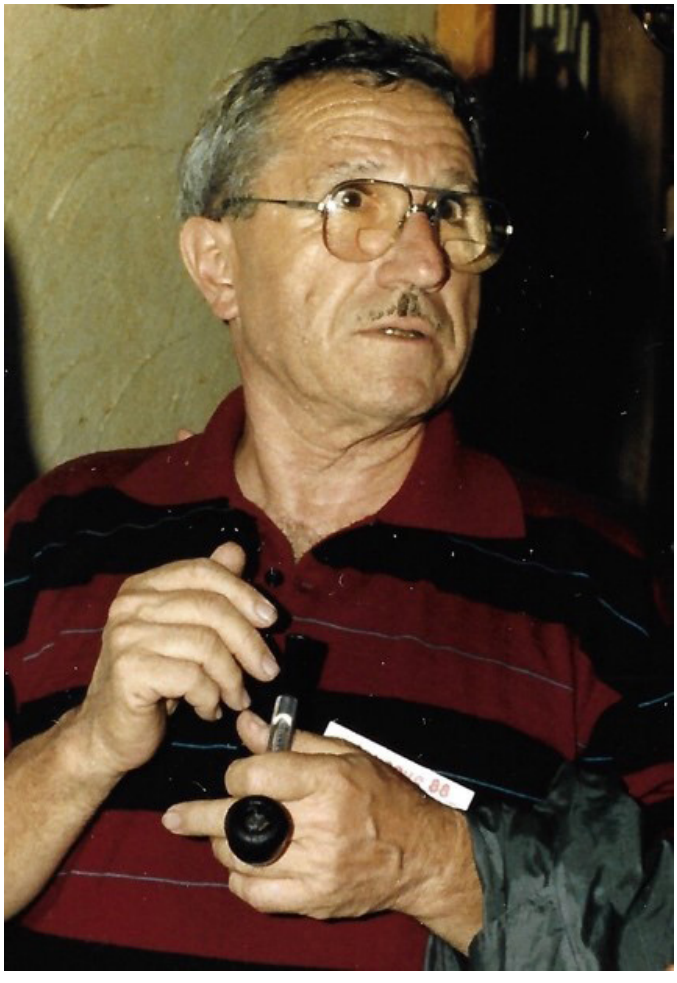
Jean Tourret

Jean Mattei was born on September 21, 1920, in Felletin (a small town in the center of France, close to Aubusson, famous for its tapestries) in a family from the Mediterranean island of Corsica (the native land of Napoleon Bonaparte). His father, a civil servant, and his mother, a teacher, soon moved to Paris, which they then had to leave after the German invasion in 1939.

In 1941, Jean returned to Paris to study at Sorbonne University. He specialized in fluid mechanics in the laboratory of Joseph Pérès at École Normale Supérieure, under the authority of Professor Yves Rocard, a well-known physicist who is considered the father of the French atomic bomb. There, Jean joined the French Résistance and became a Captain of the FFI (Forces Françaises de l'Intérieur) in charge of the Versailles-Rambouillet sector. Late August in 1944, his group opened the way to the French capital for the Allied Forces (and more specifically to the French Second Armored Division, under the command of General Leclerc), leading to the Liberation of Paris. Jean then enrolled in the 10th French Division of General Billotte, integrated in the Patton Army, spent Christmas 1944 in Belgium, and during the following winter, took part in the Alsace Campaign. From 1945 to 1946, in the context of the occupation of Germany by the Allies, he participated in the French Commission of Control in Berlin, where he had the opportunity to recruit German scientists. There, he met Muriel, a journalist and a member of the British Commission who became his dear wife.

At the demand of Yves Rocard, Jean was directed to the Ministry of War in the telecommunications domain, which led him to join the TELECOM School of Engineering, from which he graduated in 1949. In 1952, he joined ONERA (the French Aeronautical Center) in the Acoustics Division led by Pierre Liénard, where he studied ballistic waves. In 1957, he was hired by EDF (Electricité de France). He soon became Head of the Acoustics Division and later Head of the Acoustics and Vibration Department (the Acoustic Division being under the responsibility of Paul François and later of Jacques Delcambre and the Vibration Division under André Jaudet). There, he developed strong competences in the domains of machinery acoustics and environmental noise as well as new tools for vibroacoustic studies such as sound intensity.

He was named Scientific Advisor of EDF in 1982. While at EDF and throughout his career, Jean was involved in major French and international activities linked with noise control engineering. For 20 years, he chaired the Acoustics Commission of AFNOR, the French Standardization Body (with a production of over 100 standards



Jean Mattei during INTER-NOISE '88 in Avignon

in the domain), and he was also involved in ISO TC 43 "Acoustics" activities, where he established strong personal links with several members (including Bill Lang and Gerhardt Hübner.). At the end of the sixties, Jean became the president of GALF (the Association of French Speaking Acousticians, which later became SFA, the French Acoustical Society). There he developed GAIE, the Industrial and Environmental Acoustics Group, which would become a member of I-INCE.

In 1969, Jean became a member of the ICA (International Commission of Acoustics, the seventh commission of IUPAP). He served as the Chairman from 1972 to 1975 and in 1983 organized the 11th ICA Congress in Paris as General Secretary.

In 1975, Jean was the executive president of the FASE Colloquium on Machinery and Environmental Noise, the first European Congress of Acoustics organized in Paris by the Federation of European Acoustical Societies.

In this same period, he was named a corresponding member of INCE-USA. From 1975 to 1988, Jean was director-at-large of I-INCE, and in 1988, he chaired the INTER-NOISE Congress, held in Avignon, France, where he was proud to welcome in the famous Palais des Papes over 800 delegates from 45 countries. Jean continued to serve the noise control engineering community by participating in the board of I-INCE, also encouraging the foundation of INCE/Europe and the organization of international meetings.

Jean Mattei and Bill Lang in Avignon

Jean had and still has a passion: sailing. He used to own (successively!), not less than five boats that he sailed through the Mediterranean Sea and Atlantic Ocean. In the last decade, he boarded several sailing cruises all over the globe, such as from the Red Sea to Indian Ocean, Valparaiso to Singapore, Greenland to Alaska.

Jean has always been a strong-willed person, setting high standards for himself as well as for others, with a deep sense of friendship and loyalty. He has brought to the French and international noise control community a vivid impulse to increase its development and worldwide recognition.

Jean Mattei was awarded the French Medal of Resistance and named Chevalier de la Légion d'Honneur.

SoundPLAN launches SoundPLANnoise Version 8.2—The World-Leading Noise Modelling and Mapping Software

Jochen Schaal, managing director of SoundPLAN GmbH said, "Our software was designed to meet the growing acoustic and noise planning needs of the engineering community. SoundPLANnoise provides comprehensive noise modelling and noise-mitigation planning tools. The software offers graphical presentation features that are professional, easy to use, and deliver engineering results in a clear and comprehensible way to the user, the client, and the community. SoundPLANnoise offers an opportunity to engineers to expand and provide consulting services to their clients and community."

In the past years, SoundPLAN has worked on a number of exciting developments in the field of environmental noise prediction, including Geographic Information System (GIS) integrations and prediction tools for interior room acoustic modelling and assessment. With the release of SoundPLANnoise v.8.2, these developments are available and provide new features and enhancement for our customers.

Key new features in SoundPLANnoise v.8.2 include the following:

- **New project organization tools**, which enable the user to work more efficiently and faster
- **New CNOSSOS-EU Standards** for road, rail, and general environmental noise
- **New documentation for the noise barrier optimization**
- **New visualization options for interior noise mitigation design**

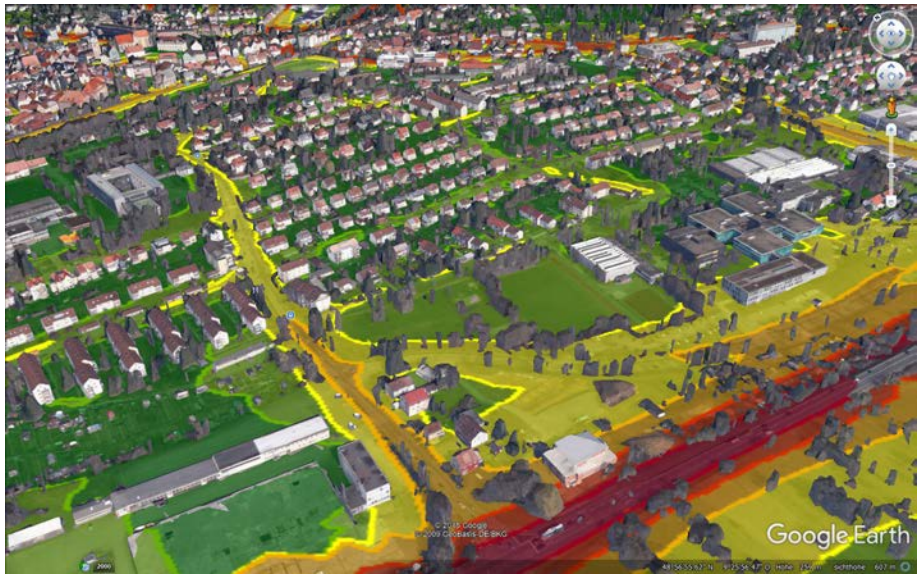


Fig. 1. SoundPLANnoise 8.2 combines environmental data with terrain maps, such as Google Earth, to give you a very realistic picture of how the noise would propagate.

Fig. 2. For a calculation in rooms, SoundPLANnoise provides planning tools to incorporate different acoustic concepts with different screens and/or absorbers for open offices, restaurants, and other workspaces.

The software offers intuitive input tools to develop 3-D environmental and interior noise models. SoundPLANnoise predicts current or future noise impact, source ranking, optimization, and noise mitigation options. The software is an engineering tool that allows city planners; architects; and construction, plant, civil, environmental, and acoustical engineers to quickly develop the project geometry and acoustic models. The user selects the standards, and the applicable assessment and SoundPLANnoise provides the automated noise modelling prediction algorithm, the documentation, and the presentation of results.

To view an online-only video for this article, please click here to visit the article on the *NNI* blog, where figure 4 is included showing an update of the interface to d&b audiotechnik's ArrayCalc in version 10.10.1 that means that the A- and SL-Series loudspeakers can now also be included.

For more information about SoundPLANnoise 8.2, visit www.soundplan.eu/ or send us an email at forschner@navcon.com or marketing@soundplan.de.

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About SoundPLAN

SoundPLAN GmbH in Backnang, Germany, is an engineering company with a focus on noise control and software development. Its interdisciplinary team consists of engineers, geographers, physicists, and computer science specialists. The team generates cutting-edge engineering solutions delivered to the global market in the format of our SoundPLAN software. SoundPLAN noise modelling software has maintained its status as the market leader worldwide for more than 35 years.

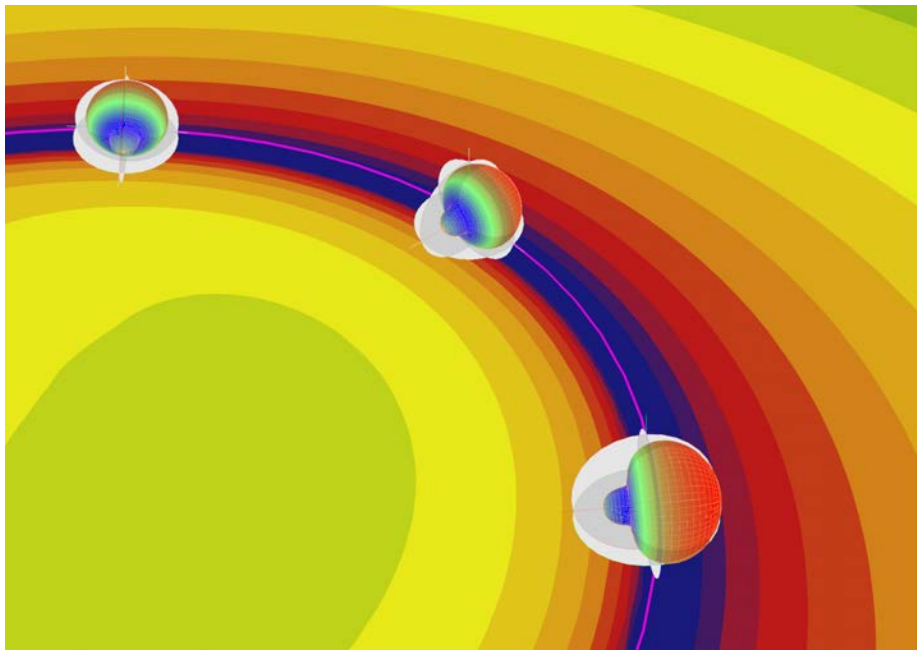


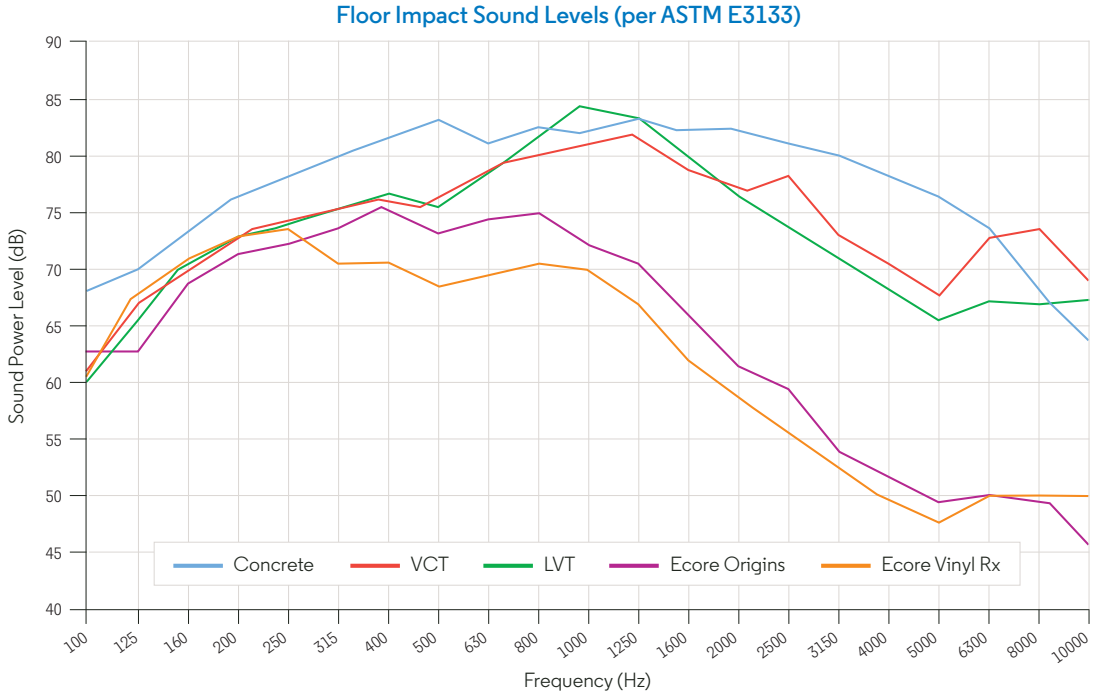
Fig. 3. For the consideration of a directivity assigned to a line source, there is a new option, "directivity follows the line source." This makes it very easy to model racetracks, for example, and eliminates the need for manual splitting into subsources.

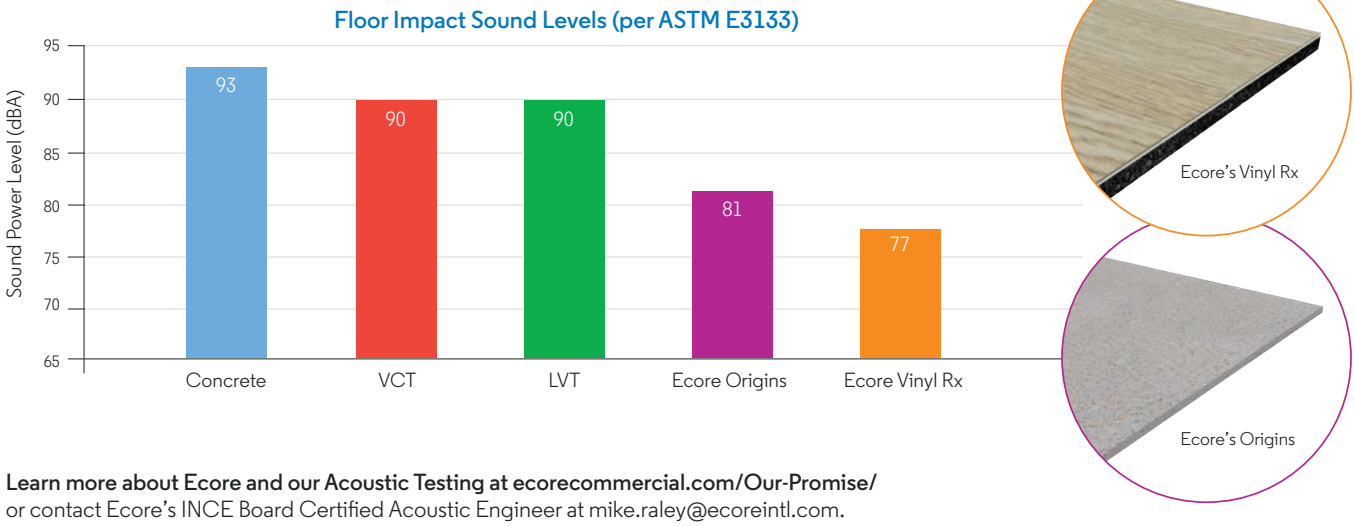
ecore™

New Floor Impact Sound Test Data available from Ecore

PERFORMED BY INTERTEK INDEPENDENT IAS-CERTIFIED LAB IN YORK, PA

Floor impact sound levels from Ecore's Vinyl Rx were 13dB lower than those from generic VCT and LVT. This makes Vinyl Rx an excellent choice for uses like hospitals where the standard flooring choice to reduce noise, carpet, presents many maintenance and health issues.





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Time It Takes to Approach Steady State

Eric E. Ungar

Acentech, Inc., Cambridge, MA

Introduction

In dealing with a structure or a mechanical system that is subjected to a vibratory force, such as that due to a rotating machine, it is common in practice to consider only how the system responds in the steady state—that is, after the excitation has been applied for a considerable time.

In theory, reaching the steady state takes infinite time—the final steady state is never reached. But how long does it take to reach a given fraction of the steady state response?

Analysis Approach

Consider the classical simple mass-spring-damper system consisting of a mass m that is mounted to a rigid support via a parallel arrangement of a spring with stiffness k and a damper with viscous damping coefficient c, and assume that a sinusoidal force of amplitude F and radian frequency ω acts on the mass. For such a system, the displacement x of the mass m from its equilibrium position in terms of time t obeys the well-known differential equation

$$m\frac{d^2x}{dx^2} + c\frac{dx}{dt} + kx = F\cos\omega t \qquad (1)$$

the complete solution of which consists of the sum of a steady-state component $x_s(t)$ and a transient component $x_T(t)$. One may

obtain expressions for these components by following the usual analytical procedures. The mathematical steps are not presented here, but the results are summarized below.

The magnitude X_S of the steady-state component may be found to obey

$$X_S^2 = X_{st}^2 / \Delta \qquad (2a)$$

with $X_{st} = F/k$ denoting the static deflection of the mass due to a steady force of magnitude F and

$$\Delta = \left(2\varsigma\beta\right)^2 + (1-\beta^2)^2 \qquad (2b)$$

Here $\beta = \omega/\omega_n$ is the ratio of the radian frequency ω of the applied force to the system's radian natural frequency $\omega_n = \sqrt{k/m}$. Also, $\zeta = c/c_c$ with the critical damping coefficient c_c given by $c_c = 2\sqrt{km}$.

For the commonly considered case where the system is at rest and undeflected from equilibrium before the force is applied, one finds that the magnitude X_T of the transient component obeys

$$X_T^2 = \frac{X_{st}^2 \exp\left(-2\omega_n t\right)}{\Delta\left(1-\varsigma^2\right)} \qquad (3)$$

Thus, the ratio N of the magnitude of the transient component to the magnitude of the steady-state component is given by

$$N = \frac{X_T}{X_S} = \frac{\exp\left(-\varsigma\omega_n t\right)}{\sqrt{1-\varsigma^2}} \rightarrow \exp\left(-\varsigma\omega_n t\right) \qquad (4)$$

where the latter form is an approximation for the often considered practical case of small damping. Since the total motion consists of the sum of the steady-state and transient components, the total motion nears the steady state as the transient decreases—that is, as N becomes smaller.

Results and Observations

As evident from equation 4, the ratio N depends on the system's natural frequency but not on the frequency of the excitation. Further, this equation implies that the time T_N it takes for the magnitude of the transient to decay to a given fraction N_c of the magnitude of the steady-state component obeys

$$T_N = \frac{-\ln\left[N_c\sqrt{1-\varsigma^2}\right]}{\varsigma\omega_n} \rightarrow \frac{-\ln N_C}{\varsigma\omega_n} \qquad (5)$$

and that the number of cycles n_N it takes to reach the fraction N_c is

$$n_N \approx f_n N_c = 2\pi\omega_N N_c = -\frac{2\pi\ln\left(N_c\right)}{\varsigma} \qquad (6)$$

Note that n_N depends only on the value of the damping ratio.

For example, consider how long it takes for the response of a system with 3% of critical damping and a natural frequency of 15 Hz to reach 99% of its steady-state amplitude. This is the time it takes for the transient amplitude to decay to 1% of the steady-state amplitude and may be found here to amount to $T_N \approx -\frac{\ln\left(0.01\right)}{\left(0.03\right)\left(2\pi\right)\left(15\right)} \approx 1.63\,\text{sec}$. This corresponds to 1.63(15) = 24.4 cycles.

As apparent from equation 5, the time it takes for the transient to reach a given small fraction of the steady-state magnitude is shorter for (a) greater damping and (b) greater natural frequencies. This agrees with what one would expect since the transient motion is that of a system that is disturbed initially and then vibrates freely with decaying amplitude due to its damping.

New Features and Options in the *Noise Control Engineering Journal*

Jim Thompson
NCEJ Editor

Since 1973, the *Noise Control Engineering Journal* (*NCEJ*) has been the leading journal dedicated to noise control. In the almost 50 years since that time, there have been a lot of changes and improvements to *NCEJ*. We are now fully electronic with a highly automated submission and review process. Our outstanding editors are leaders in their respective technical areas and do an outstanding job reviewing the hundreds of papers we receive each year.

One of the recent innovations in the journal was the addition of case studies. These are articles aimed at providing guidance or a reference for practicing noise control engineers. They often do not reference cutting edge technology but provide expertise in the solution of noise control issues and the use of measurement and modeling techniques to understand noise control problems. Since their introduction in 2018, we have received roughly 100 of these case studies and typically publish one or two in each issue.

This year we have especially invited noise control papers regarding artificial intelligence (AI). This effort is led by Yang-Hann Kim of the Korean Society of Noise and Vibration Engineering (KSNVE). He is also the Asia-Pacific Region Associate Editor for *NCEJ*. This is a strong area for noise control development in the future, and we want to provide technical papers on this vital subject. If you would like to submit or talk with Yang-Hann Kim about preparing a paper, please contact him at ncej@ksnve.org.

In the next few years, we will be taking another innovative step to ensure that *NCEJ* remains the leading journal for noise control engineering: We will be offering authors the opportunity to publish their papers with open access—that is, for a fee, their paper's copyright will allow the authors and others to freely share their papers. This contrasts with the more traditional subscription model where the reader must pay a fee per paper or subscribe to the journal to be able to download papers. All INCE-USA members get this subscription as part of their membership.

Open access is a growing trend in the scientific community. Many research funding agencies require open access for publications from their funded research. This is nearly universally true in Europe and is becoming more common around the world. It is important that *NCEJ* offer this option to continue to attract top quality papers and facilitate the citation of our papers in publications around the world.

For authors, the paper submission and review process will remain the same. The only difference will be that once the paper is accepted, the author will have the option to select open access or subscription publication.

I cannot end without inviting you to submit your technical paper or case study to *NCEJ*. For more information on the submission process, the differences between a technical paper and a case study, or the required format, please go to https://www.inceusa.org/publications/noise-control-engineering-journal/. You can also go directly to our submission site at http://ncej.edmgr.com/. A submission to *NCEJ* is the best way to make your work known to those working in noise control around the world. In addition, you are supporting INCE-USA and *NCEJ*.

We have a continuing need for reviewers. If you would be willing to review *NCEJ* technical papers or case studies, please go to http://ncej.edmgr.com/ and register. Please take the time to complete the section on the subject classifications that are of interest to you. This will make sure you receive papers in your areas of interest. Serving as a reviewer provides the opportunity to see the latest developments in noise control engineering while contributing to INCE-USA. The time commitment is minimal, requiring only a few hours per month. This is a rewarding way to contribute to the noise control profession.

NCEJ will continue to innovate to provide the best opportunities to INCE-USA members and others to publish the latest research and discussions of noise control engineering. We always welcome submissions and input on how we might improve. Feel free to contact me at editorNCEJ@inceus.org.

From the Archives: INTER-NOISE 2003: Report

As you know, INTER-NOISE 2020 was scheduled to be held in Seoul, South Korea, this year. However, due to the pandemic and associated travel restrictions, it has been moved to an e-congress. To mark the occasion, in this issue's From the Archives feature, we decided to reissue the conference report from the last time INTER-NOISE was held in South Korea…back in 2003! Take a trip down memory lane, and learn what a conference from 17 years ago looked like.

General Secretary Jeong-Guon Ih, made a few remarks at the opening session and then introduced the Congress President, Hee Joon Eun who welcomed delegates on behalf of the INTER-NOISE 03 organizing committee. Then followed the official opening of the congress by International INCE president Tor Kihlman. There were two co-presidents of the congress, Young-Pil Park, president of the Korean Society for Noise and Vibration Engineering, and Chun-Duck Kim, president of the Acoustical Society of Korea who also welcomed the delegates on behalf of their professional societies. Local greetings were also brought by a representative of the provincial government.

In addition to the congress opening with a Korean drum, delegates were well entertained by a musical performance on a traditional Korean stringed instrument. The session was very well balanced with practical information on the activities to take place during the congress, introductory remarks, and Korean cultural elements.

Secretary General Jeong-Guon Ih offers practical advice on the INTER-NOISE Congress.

Jang Moo Lee, a professor at Seoul National University presented the keynote lecture, which was titled "Analysis of structure-borne sound of various systems." The purpose of his lecture was to give some examples of structure-borne sound radiation, and to compare some very old structures to modern structures. Using the principles of cavity resonance, he showed that the generation of sound in a 1300-year old Korean bell is similar to the generation of sound in a passenger vehicle with a trunk. He went on to discuss the acoustical characteristics of

Jang Moo Lee presents the opening keynote address.

A performance on a Korean drum opens INTER-NOISE 03.

bells—comparing the sound of a Korean bell with the Liberty Bell—and discussed the shapes of bells from Korea, China, and Japan. He presented some principles of bell design and modeling—for example modeling a bell as a variable-thickness cylinder. He returned to more modern problems such as the radiation of structure-borne sound into a vehicle interior. He emphasized structural and acoustical coupling, and presented a study of the effect of an air gap between the roof and headliner of a vehicle, which can be used to reduce sound levels. He also discussed the treatment of a passenger car compartment and trunk as a coupled system—treating the car and trunk as separate cavities. He completed his lecture with a discussion of active control of a car floor to reduce sound levels and an analysis of the squeal of disk brakes.

Following the opening session, a welcome reception for all delegates was held in the Sunken Garden of the ICC Jeju Convention Center. Unfortunately, the

From left to right: Congress President Hee Joon Eun welcomes the delegates; International INCE President Tor Kihlman describes I-INCE activities and opens the congress; Young-Pil Park, President of the Korean Society for Noise and Vibration Engineering, brings greetings from KSNVE; Chun-Duck Kim, President of the Korean Acoustical Society brings greetings from ASK; A local government representative welcomes delegates to Jeju Island.

weather did not cooperate for the planned outdoor reception.

The following morning, Michael Vorländer, a professor at Aachen University in Germany presented the second plenary lecture titled "Auralization in noise control." One key question in noise control, he said, is how to interpret the results of an acoustical analysis. For example, single-number ratings can be misleading and two sounds may have the same one-third octave band spectrum, but may sound quite different. Auralization, he said, is a tool for making judgments by listening to sounds created by a source and a filtering system, which may be quite complex. Although the basic analysis tool is convolution, signals have many dimensions (loudness, etc.), and decisions must be made as what is important. He turned to the problem of source/transmission path interactions, and then to various analysis methods—finite element modeling, boundary element modeling and statistical energy analysis—and how they affect the choice of a filter to model system performance. He gave examples of auralization in room acoustics and factory noise.

Michael Vorländer presents the second keynote address.

He discussed the tapping machine as a source of impact sound and the need to determine both the impedance of the source and the impedance of the floor in order to make a realistic model for auralization studies, and presented preliminary results. He then turned to binaural transfer path synthesis where both a airborne path and a vibration path may exist, and gave studies of washing machines and vehicle noise as examples. In closing, he suggested that auralization could be added to visualization for marketing and other purposes.

INTER-NOISE 2003 Exposition

The exposition was managed by Duck-Joo Lee from the Korea Advanced Institute of Science and Technology. The booths were well-placed in a central area of the conference center. Thirty-six exhibitors from 10 countries participated in the exposition, and occupied 48 exhibit booths. Companies participating were:

- 01dB Acoustics and Vibration-Metravib Technologies, France
- ABC Trading, Korea
- Acoustics Group, Korea Institute of Machinery and Materials, Korea
- ATES, Korea
- AVT Co., Ltd., Korea
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INTER-NOISE 2003: Report *continued*

Stuart Bolton (top) presents the third keynote address; Young-Pil Park (center) presents the fourth keynote address; Paul R. White (bottom) presents the fifth keynote address

Professor Stuart Bolton of Purdue University, USA gave the third plenary speech titled "The reduction of tire/road interaction noise."

Professor Yong-Pil Pak of Yonsei University, Korea gave the fourth plenary presentation titled "Noise and Vibration in Information Processing Devices." He gave examples of various noise sources in information processing—such as paper feed mechanisms, printers, scanners, hard drives and optical drives, and reviewed some of the things people say about computer noise. Manufacturers, he said, are forced to reduce noise and vibration from their equipment not only because of its effect on users, but because the noise and vibration may affect the operation of the mechanism itself. He identified fan noise as the main source of noise from computers, but then turned to hard disks and optical disks as important sources of noise—not only in computers, but in many other pieces of equipment such as home electronics and communications equipment. The tendency to make this equipment smaller and smaller, he said, causes problems with key dimensions well below that of the diameter of a human hair. There are also benefits, he said, such as recording densities up by a factor of 104 while prices drop by a factor of 103.

He then discussed analysis techniques such as sound power determination, scanning systems using sound intensity, vibration measurements using accelerometers and laser doppler vibrometers, and methods for measuring sound absorption (2-microphone method). He illustrated how sound intensity maps can be used to identify ball bearing defects in hard drives—with 5-8 dB noise reductions after control measures are introduced. He said that air flow turbulence can affect the performance of hard drives and optical drives.

He discussed spindle system design and touched briefly on smart spindle systems, smart isolation mounts, and piezoelectric shunts. He concluded by saying that it is very important to pay attention to noise and vibration in information processing systems not only because of annoyance to users, but because of important performance issues.

Paul White of Southampton University, UK gave the fifth keynote speech titled "Non-stationary and non-linear signal processing." Traditional signal processing techniques, he said, depend on classical assumptions such as linearity, and stationary gaussian signals, but that modern digital signal processing techniques can remove the need for such assumptions. All real systems are non-linear, non-stationary, and non-gaussian, although the classical assumptions may be a good approximation to the real situation. He discussed complicated signals such as speech in connection with time-frequency analysis, and various models which are non-linear where filter coefficients may vary with time. He also discussed some parametric models, and their application with respect to helicopter gearbox monitoring, and finally Volterra models for weakly non-linear systems.

Professor Toshio Sone from Akita Prefectural University, Japan gave the sixth keynote speech titled "Environmental noise and personal noise exposure." He discussed the results of several surveys taken in Japan—objective surveys to determine noise exposure in terms of 24-hour A-weighted equivalent levels and subjective surveys to determine the reaction of individuals to various sound levels and types of sound. The results include the noise exposure of workers in various occupations as well as the noise exposure as a function of the tasks performed and noise exposure as a function of means of commuting to work. The noise exposure of houswives was also studied. Then, the response of workers and residents to their acoustical environment was studied. A large fraction of the respondents were annoyed by traffic noise, and about the same fraction (60%) were just generally annoyed by environmental noise of no particular origin.

INTER-NOISE 03 delegates are entertained by a performance on a traditional Korean stringed instrument.

Toshio Sone presents the sixth keynote address.

Wen Bangchun presents the seventh keynote address.

Professor Wen Bangchun from Northeast University, China gave the seventh keynote speech titled "The progress of noise control in China." He predicted that 200 billion Yuan (about 8.2 Yuan to the U.S. dollar) is needed for control of noise in China. He said that legislation for noise control is now progressing rapidly, and that two of the "hot points" are the development of monitoring equipment and instrumentation as well as the application of new materials and structures for noise control. There are now standards in place for vehicle noise, noise around airports, and factory noise, so, he said, the basis for noise control in

cities has been established. Because China is now a member of the World Trade Organization, he said, the country must get into the international track and be concerned with both product quality and environmental protection in factories.

Transportation noise, he said, is a very serious problem in China, and a "hot point" for control of vehicle noise is the design of lightweight barriers—for road vehicles as well as rail vehicles. He gave some examples of noise barriers in Chinese cities, and said that a standard for noise barrier design would soon be published.

He discussed other serious noise problems, including subway stations and ventilating towers, and noise from elevated trains. The latter, he said, would benefit from such technologies as floating structures, acoustical materials, barriers, and damping materials. Aircraft noise is also a serious problem in China, he said, and consideration is being given to a "polluter pays" system, which will force airlines to discontinue the use of noisy airplanes.

He recognized that noise control is required in the early stages of a design because application of techniques late in the cycle is difficult and expensive. There is, he said, a Chinese instrumentation industry, but that the equipment is not as sophisticated as that available on the international market. He said that there are noise control programs in 400 factories, and that there are 10 standards in place for measurement and assessment of facilities, but that there are still disparities relative to progress on the international level, and that facilities must be improved.

He said that there is work in China on sound absorptive materials such as micro-hole perforated plates, aluminum fiber materials, perforated plates and bonded fabrics—and work on vibration isolating materials.

The trend, he said, is for noise pollution to become the biggest environmental problem in Chinese cities, and that although there has been much hard work, many techniques applied, training available, and some progress made, much more effort to control noise is required.

Philip J. Morris (top) presents the eighth keynote address; Jens Blauert (bottom) presents the ninth keynote address.

The congress banquet was held in the Lotte hotel. The speeches were short and entertaining, and the quality of the Korean food was outstanding and served buffet style. The show, with traditional dances by the Kun Hee-suk Dance Team, was very much appreciated.

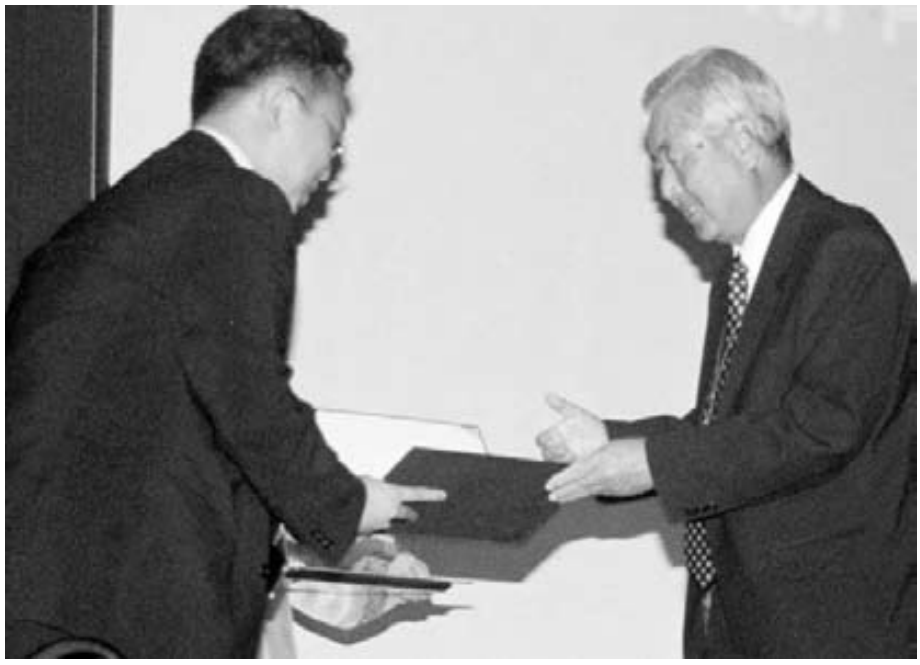
Professor Philip J. Morris of the Pennsylvania State University, USA gave the eighth keynote speech titled "Aeroacoustics: Classical and Modern Approaches." He began with the notion of acoustical analogies, the idea that the equations of fluid motion can be put into the form of a linear operator (such as the wave equation) and a source

term. He showed how the source term could be derived following the work of Lighthill, and how the well-known 8th power law followed from that analysis. He discussed convection effects, the contributions of other workers in the field, and gave an explanation of why, in the case of sound generation by turbulence, only a small portion of turbulent energy is actually radiated as sound.

He then discussed an alternative acoustical analogy that he and a co-author developed, which is based on the equations of motion written in terms of the velocity and the logarithm of pressure. One of the two source terms in the formulation can be thought of as a "vortex force." He showed how this model works better than the original analogy in the prediction of far field spectral density.

He then discussed some problems in computational fluid dynamics (CFD)—a field that has grown rapidly with the availability of very fast computers. One example he gave related to predictions of landing gear noise. He then touched briefly on thermoacoustics problems before concluding with the statement that there is great potential for CFD (for both steady and unsteady flow) and acoustical methods such as acoustical analogies for noise prediction. Unfortunately, he said, this doesn't necessarily tell one how to reduce noise.

Professor Jens Blauert of Ruhr Universität, Germany presented the final keynote speech titled "Concepts behind sound quality: some basic considerations." He said that in 1986 he was surprised to receive an invitation to give a paper at INTER-NOISE 86 on sound quality because the subject was not thought of as related to noise control engineering. However, even at that time, it was becoming clear that A-weighted sound levels were not sufficient to describe the perception of sounds. Noise is not just unwanted sound, he said, and emphasized that much of what we "hear" does not come through the ears. Psychoacoustics and an understanding of psychophysical measurements allow physical instruments to be designed to determine the "character" of sounds. This is not necessarily quality, he said because quality is related to function, and the quality of the sound of a product enables us to put a value on the character of the sound. The area of product sound quality (PSQ) shows how cognition, action, and emotion play a role in making a judgment by the user, resulting in a quality "event" as the output.



Honorary Congress President Il-Whan Cha, right, awards a poster prize at the INTER-NOISE 03 closing ceremony. A donation for the prizes was given by Finegold & So, consultants.

He then turned to binaural models, and how binaural activity can be used to study sound in concert halls, classrooms, and in cars—and also for speech recognition. He concluded with a simplified model of PSQ where the inputs are the character of the sound and some reference, and processing in terms of comparison and appraisal lead to a judgment of sound quality.

The closing ceremony followed the last keynote. One of the outstanding features of the congress was the poster sessions. There were 103 papers presented in three poster sessions, and prizes for the best posters were given by Honorary Congress President Il-Whan Cha at the closing session.

A statistical overview (updated below) of the congress was given by General Secretary J.-G. Ih, and the farewell speech by Congress President Hee Joon Eun left all of the delegates with very warm feelings about the experience of attending a congress in Korea. Finally, Ondřej Jiříček Program Committee Chair for INTER-NOISE 04, representing INTER-NOISE 04 General Chair Josef Novák, invited all of the delegates to attend the 2004 congress in Prague, Czech Republic, and showed a video of the attractions in the city. The 2004 congress will be held on 2004 August 22-25.

The total attendance at the INTER-NOISE 03 Congress was 953. This included 180 exhibition-only attendees and 39 accompanying persons. There was a total of 105 sessions—including the nine keynote lecture sessions. The technical program was very well arranged by Soogab Lee.

The proceedings of the congress were published on a CD-ROM, which contains 658 technical papers.

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

Don't forget: 2020 is the International Year of Sound!
http://sound2020.org

November 16–18, 2020
NOISE-CON 2020
E-Congress
https://www.inceusa.org/noisecon20/

June 14–17, 2021
13th ICBEN Congress on Noise as a Public Health Problem
Karolinska Institutet
Stockholm, Sweden
https://www.icben2020.se/

June 21–23, 2021
EURONOISE 2021
Madeira, Portugal
www.spacustica.pt/euronoise2021/

August 1–4, 2021
INTER-NOISE 2021
50th International Congress and Exposition on Noise Control Engineering
Washington, USA
http://www.i-ince.org/

December 6–10, 2021
181st Meeting of the Acoustical Society of America joint with WESPAC 2021 and the Australian Acoustical Society
Sydney, Australia
acousticalsociety.org/asa-meetings/

Directory of Noise Control Services

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

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Noise Control in Buildings, by Cyril M. Harris