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ACOUSTICS NEWS AND REGULAR ITEMS

SPECIAL ISSUE – ROAD TRAFFIC NOISE PART 2

GENERAL SUBMISSIONS

FROM THE PRESIDENT

It is the December issue for 2016 already. The year has been a busy one for the Society with much work being carried on behind the scenes to enable the Federal Council to better manage the Society. This has included structural changes in the way subscriptions are paid and recorded with around 80% being paid via Credit Card via our website. This has reduced significantly the associated administrative work for the General Secretary. Other changes included moving the Society website to a new host after our previous provider made incompatible software changes killing our website.

In November the Queensland Division along with the New Zealand Acoustical Society hosted the "The Second Australasian Acoustical Societies Conference" in Brisbane. The technical program for the conference included 126 papers, 13 workshop panel discussions, 3 short courses and 2 technical tours. Additionally, the trade exhibition was significant with around 45 exhibitors. The conference was very successful and a credit to the efforts of all involved.

I would like to take this opportunity to thank Tracy for her tireless work as President of the Society over the last two years. Additionally, I would like to thank the Federal and Divisional Councillors for their efforts of the last twelve months in keeping the Society working and delivering value to our members. In 2016, our General Secretary took some much needed leave. During that time Glen Copelin took on the role of General Secretary. I would like to publicly acknowledge and thank him for his efforts and devotion to the role.

I hope that you have been able to take time to enjoy the coming Christmas season and the traditional 'downtime' this period has to offer to relax and recharge for the new year. I would encourage all members to make 2017 a year of active participation in the Society by being part of the discussion, volunteering at Divisional level, supporting and attending the Technical Meetings/Functions arranged by your Divisions, to offer suggestions for topics to the Divisional Committees, etc.

Terrance McMinn
President

FROM THE CHIEF EDITOR

This December issue brings to a close the 44th volume of Acoustics Australia and the second volume for which Springer has been responsible for the publication of the papers, while the Australian Acoustical Society (AAS) continues to have the editor duties and to produce the news and notes. Over these two volumes, there has been less work for the AAS in the mechanics of the management of the papers, the reviewers and the publication of the final accepted manuscript as this is handled by Springer. However, because of the large increase in the number of submissions each year, there is now more work for the editor in checking each submitted manuscript, assigning to reviewers, checking the reviews and dealing with the problems that can arise. During 2017, I will be seeking a deputy editor to assist with these tasks and anyone who wishes to be involved should contact AcousticsAustralia@acoustics.asn.au with their "expression of interest".

This issue includes contributed papers plus the final papers on traffic noise gathered by the special issue editor Marc Buret; traffic noise was the focus for the August issue. In 2017, we plan for a special issue on underwater acoustics and a special issue on wind turbine noise. We are expecting that both these issues will include papers by Australian and international authors. At any time, contributed papers on relevant acoustic topics are very welcome and especially those from practitioners.

Marion Burgess
Editor in Chief

AUSTRALIAN ACOUSTICAL SOCIETY ENQUIRIES

NATIONAL MATTERS

* Notification of change of address
* Payment of annual subscription

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ACOUSTICS AUSTRALIA 44(3), 2016 ABSTRACTS

The full papers for these abstracts can be found in the online version of Acoustics Australia.

Members of the Australian Acoustical Society should access via the member login of the AAS website. Access for all others is via http://link.springer.com/journal/40857

SPECIAL ISSUE ROAD TRAFFIC NOISE PART 2

TECHNICAL NOTE

COMPARISON OF ROAD TRAFFIC NOISE PREDICTION MODELS: CORTN, TNM, NMPB, ASJ RTN

Simon de Lisle

Arup Acoustics, Sydney, Australia

This research investigates the prediction accuracy of Calculation of Road Traffic Noise (CoRTN), Traffic Noise Model version 2.5 (TNM), Acoustical Society of Japan-Road Traffic Noise (ASJ RTN) and Noise Propagation Computation Method Including Meteorological Effects (NMPB). A test case model was constructed to investigate the combination of ground effect and shielding in each methodology. The predictions for CoRTN are implausible, because predicted noise levels for soft ground are equal to hard ground in some locations. This anomaly was not present in predicted noise levels from TNM, ASJ RTN and NMPB for the same test case. Noise levels for a rural freeway and an urban freeway were predicted for each methodology and compared with noise monitoring results. CoRTN resulted in high over-prediction. TNM and NMPB produced similar results, with TNM predicting slightly higher on average and NMPB having the lowest standard deviation in the prediction error. ASJ RTN resulted in high under-prediction.

ADDENDUM TO: ACOUSTICS AUSTRALIA

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The author would like to add the following comment to the original Technical Note.

For traffic noise prediction, the CoRTN method has been found to successfully predict the traffic noise in a large number of situations in Australia and overseas. The intent of this Technical Note was to investigate exceptional circumstances which may be at the boundary of the capability for CoRTN and to compare CoRTN predictions with measured values and with predictions from three other methodologies: TNM, NMPB and ASJ RTN. It is only by better understanding the limitations of each methodology that when faced with unusual situations, there is a better understanding of the limitations of the resultant predicted noise levels.

GENERAL SUBMISSIONS

ORIGINAL PAPERS

A NOVEL DUAL-CHANNEL MATCHING METHOD BASED ON TIME REVERSAL AND ITS PERFORMANCE FOR SOUND SOURCE LOCALIZATION IN ENCLOSED SPACE

Ma Huiying Zeng Xiangyang, Wang Haitao

College of Marine Science and Technology, Northwestern Polytechnical University, Xi'an, China

For sound source localization in enclosed space, the background noise and reverberation have significant influences on traditional localization algorithms and the array, and these algorithms are usually complex. A sound source localization method called dual-channel matching is proposed in this paper. The method is based on the theory of time reversal. It has strong anti-reverberation capability and the ability to overcome multipath effects. A series of sound source localization experiments were carried out in an underground parking lot, where the real-time performances of the method under different dimensions of sound source devices, SNR, and reverberation were evaluated. The parameters regarding the microphone, obstacle's influence, different heights between sampling and localization processes, and localization of slow-moving sound sources were also evaluated. The results and their analysis show that (1) high spatial resolution can be obtained while the

sound devices satisfy the requirement of the radiated acoustic energy, and that the smaller the size, the smaller is the error range which corresponds to higher spatial resolution; (2) when the SNR is greater than 2 dB, spatial resolution in common room is 10 cm; (3) spatial reverberation has little effects on localization resolution; (4) the method has strong tolerance for environment; and (5) when the sound source moves slowly, this method also has a good localization effect.

ERROR ANALYSIS ON BEARING ESTIMATION OF A TOWED ARRAY TO A FAR-FIELD SOURCE IN DEEP WATER

Kunde Yang, Hui Li, Chuanlin He, Rui Duan

Key Laboratory of Ocean Acoustics and Sensing (Northwestern Polytechnical University), Ministry of Industry and Information Technology, Xi'an, China and School of Marine Science and Technology, Northwestern Polytechnical University, Xi'an, China

Multipath arrivals received by a towed array with different arrival angles result in a bearing estimation error (BEE) when conventional beamforming is used in the real ocean waveguide. This paper investigates the errors based on simulated data, focusing on their dependence on the range and bearing of a far-field broadband source. The BEE varies periodically with range, reaching local minima and local maxima at the edges of convergence zones (CZs). The estimated source bearing always lies between the true source bearing and the broadside direction of the towed array. The physical mechanism is analyzed by using normal-mode theory for theoretical interpretation and the ray method for perceptual analysis. Based on conventional beamforming, the approximate analytical solution of the beam-forming output is derived in terms of normal modes and can predict the BEE quantitatively. The ray trace is used to illustrate the range dependence. The BEEs for different ocean depths are also discussed and the results can be used as auxiliary information for source localization.

METHODS OF DESIGNING SHALLOW UNDERWATER ACOUSTIC CHANNEL SIMULATORS

Do Viet Ha[1,2], Van Duc Nguyen[1]

1 School of Electronics and Telecommunications, Hanoi University of Science and Technology, Hanoi, Vietnam

2 University of Transport and Communications, Hanoi, Vietnam

In this paper, two typical methods of designing underwater acoustic (UWA) channel simulators, the geometry based and the measurement based, are investigated. Then, the performance of each method is analyzed by comparing the statistical properties of the simulated channels with those of the real shallow UWA channel measured in Halong bay, Vietnam, in June 2015. The results show that the measurement-based channel simulator provides the simulated channel which matches well with the real UWA channel, but it requires application of complex optimization computation methods to estimate a larger number of channel parameters. The geometry-based simulator has a lower complexity than the measurement-based simulator. However, the statistical properties obtained by this simulator do not fit with those of the real UWA channel. This is our motivation to propose an effective channel simulator, which is not only simple in computation but also in good agreement with the real UWA channel. The parameters of the proposed UWA channel simulator can be directly exploited from the measurement data without applying any optimization computation method. Moreover, the simulation results show that the channel statistical properties obtained by the proposed method match well with those of the real UWA channel.

TECHNICAL NOTES

IMPROVING THE ACOUSTICAL PROPERTIES OF AN ELLIPTICAL PLAN SPACE WITH A CABLE NET MEMBRANE ROOF

Fabio Rizzo, Paolo Zazzini

Department of Engineering and Geology, University of G. D'Annunzio, Chieti-Pescara, Pescara, Italy

Textile roofs are particularly suited for covering large open spaces. They are used to make buildings that are able to dynamically change their functions. Their strengths are their great lightness and thinness. These characteristics are optimal for their load bearing function, as a roof covering, but they are not so good for the acoustic performance of the structure. This aspect is important because it makes it difficult to transform a sports arena, for example, into a music hall or auditorium. The possibility having these transformations is economically important for this kind of building. This paper is focused on the acoustic performance of a building covered with a flexible roof made of a cable net and membrane. In this specific case, the roof has a hyperbolic paraboloid geometry, and the building footprint is elliptical. The interaction between shape and acoustic performance is investigated. An acoustic improvement is proposed for the double functional aim of satisfying both speech and music. This improvement is obtained using acoustic absorbing and diffusing panels.

STUDY ON THE ACOUSTICAL PROPERTIES OF NATURAL JUTE MATERIAL BY THEORETICAL AND EXPERIMENTAL METHODS FOR BUILDING ACOUSTICS APPLICATIONS

Pritesh Vishwasrao Bansod, Tushar Mittal, Amiya Ranjan Mohanty

Department of Mechanical Engineering, Indian Institute of Technology, Kharagpur, India

Noise control treatment is essential to maintain a quiet and comfortable environment in buildings. In order to control noise, sound absorbing materials play a significant role. Nowadays, natural materials have gained importance in noise control field. In this study, acoustical characterization of a natural material jute is performed using experimental and numerical techniques. Normal incidence sound absorption coefficient and sound transmission loss of building materials using jute are predicted using the transfer matrix method. The theoretical and numerical predictions show a good match with the experimental data in the mid and high-frequency range of interest.

AAS NEWS

From the General Secretary

Many thanks to Glen Copelin for filling in as General Secretary while I was on extended leave from mid-March to the beginning of October 2016.

To date, it has been a record year for new membership applications, with 68 at the time of writing compared with 49 in 2015 and 48 in 2014. However, this must be balanced against the 94 members who were lapsed at the beginning of the year, along with the loss of all their rights and privileges. The reason for members being lapsed is non-payment of annual subscriptions, in spite of more than reasonable attempts to contact members, by the General Secretary and divisional secretaries, by email, messaging and direct phone calls.

Regrettably, even now there are still 96 members who have not paid for the current subscription year (2016-2017) despite sending out the actual invoice, reminder notices and Final Notices in July, August and October.

Members should know that under the Society rules, subscriptions are payable in advance and unpaid subscriptions become liable for late fees if not paid by 31 August.

The Society will not continue to accept overdue fees that were due on 1st July 2016, as unpaid subscriptions interfere with the Society's cash flow and hinder the payout of awards and grants that the Society and Divisions makes under its charter in the promotion of acoustics and other activities.

Members currently in arrears risk being lapsed, with a consequent loss of all rights and privileges and will need to apply for reinstatement to again claim membership of the Society.

The secure on-line payment system has worked flawlessly, already this year around 400 members have taken advantage of our credit card payment facility. To pay on-line you will need to logon to the AAS website using your email address and password and then navigate to SPECIAL MENU>Subscriptions Details.

Subscriptions were last increased in 2013 and following a Council decision in 2015, it was resolved to increase membership subscriptions in line with the CPI. Consequently, for the 2017-2018 subscription year there will be an increase in membership fees of around 6% according to grade. Members and Fellows subscriptions will increase to $160.00, Graduates $122.00-$160.00, Associates and Subscribers $122.00, Retired $48.00.

Richard Booker,
General Secretary

NEWS FROM THE DIVISIONS

SA Division

The SA division of the AAS held our AGM on 24 October 2016, which took place at the University of Adelaide and was attended by about a dozen members. Following the meeting, Valeri Lenchine from the SA EPA gave a talk on strategic noise mapping of the Adelaide CBD. The strategic noise mapping used predictive modelling coupled with indications of six noise monitoring stations deployed over an approximately 12-month period. The noise monitoring stations were located in the busiest part of the Adelaide CBD, to capture noise impact from several major noise sources. This allowed for detailed analysis of noise contribution from various noise sources. The results of this study will assist with more effective noise management and urban planning decisions to reduce noise impact in the city.

The SA Division is also looking forward to our Christmas dinner, which will be held at 2KW Bar and Restaurant on Thursday 15 December 2016. It's looking like this event will be well attended, with the majority of the available places already booked. However, if you're interested in attending contact Darren Jurevicius as there may still be one or two spare seats.

Jon Cooper

Vic Division

Professor Peter Blamey gave a presentation to the Vic Division on "Acoustics, Speech and Hearing Aids" following our AGM on 27 September 2016. The talk was about the acoustics of speech (including a little acoustic phonetics), the effects of hearing loss on speech perception, and sound processing for hearing aids to maximise the speech perception benefits all acoustic environments.

Peter is a Physicist who was involved in cochlear implant and hearing aid research for 25 years, before founding Dynamic Hearing Pty Ltd to license sound processing technology to hearing aid and headphone companies, and later founding Blamey & Saunders Hearing Pty Ltd to manufacture and sell hearing aids direct to consumers in Australia. Along the way, his research led to over 250 publications and 25 patent applications. Peter was honoured with a Clunies Ross medal in 2012 for taking an invention through development to a successful commercial outcome.

Blamey & Saunders Hearing diagnose hearing impairment on-line through speech perception and phonetic testing rather than through the loudness tests traditionally conducted by audiologists. The advantages of this approach are numerous: no requirement for audiology booths; no need for the specialised or calibrated equipment at the user end and a one-on-one appointment with an audiologist is not necessary. The hearing aids are delivered via post and fine tuning can be conducted either on-line, using the company's 'IHearYou' app, or through a visit to a clinician if preferred.

The accuracy of the on-line test has been extensively researched by Blamey & Saunders Hearing and the results indicate that it is equal to traditional tests.

The hearing aids incorporate technological advancements in signal processing made during Professor Blamey's involvement in cochlear implant research. Ongoing research and development into microphone technology have been used to optimise hearing aid clarity and signal to noise ratio.

Peter is motivated by the desire to remove the barriers to improving hearing. Hearing impairment leads to general loss of engagement with the world as we age and is a risk factor for dementia. By providing a lower cost, technically excellent and user focussed alternative for diagnosing and treating hearing loss, Blamey & Saunders Hearing hope to engage with a sector of population that have resisted help in the past.

Dianne Williams

NSW Division

The NSW Division of the Australian Acoustical Society held its 46th Annual General Meeting on 19 October 2016. The AGM was followed by a technical meeting presented by Nick Boulter from Arup, discussing The Victoria Theatre and Victoria Concert Hall refurbishment in Singapore. This talk was enjoyed by all and covered a large range of acoustic issues, with a number of interesting stories from the project like façade testing using F1 cars.

Other meetings held by the NSW Division include:

Cross Laminated Timber: acoustic performance and BCA compliance by Joel Parry-Jones from PKA; and Improving Co-operation and working arrangement between COS Council and Acoustic Consultants by Bill Potter from Sydney City Council.

The NSW Division made travel grants available for two Early Career Researchers and two Research Students to attend Acoustics 2016, Brisbane. The travel grants went to Kiri Mealings, Macquarie University; and Weicong Li, UNSW.

Travel awards were also made available for two Research Students to

attend the International Workshop on Railway Noise, Terrigal (12 – 15 September) but no applications were received.

John Wassermann

WA Division

The Western Australian Division recently held their annual one-day State Seminar at Perth Zoo on October 7. It featured 13 presentations from members and invited guests, drawing over half of the current membership.

More recently, the annual WA Division Christmas lunch was on Friday December 9 at Mayfair Lane in West Perth. It was a well-attended event, and was a great opportunity for members to catch up and celebrate the year drawing to an end.

Following on from this years' successful conference in Brisbane, the next conference of the Australian Acoustical Society, Acoustics 2017 Perth, will be held from November 19-22, 2017. The conference will be held in the City of Perth at the five-star Pan Pacific Hotel, within easy walking distances to the new Elizabeth Quay and rejuvenated city centre with renowned restaurants and bars.

The full program of specialist workshops and social events will complement leading technical presentations. The distinguished speakers and invited experts include Chris Allen, NASA (Acoustics issues with Spaceflight Vehicles / International Space Station) and Dr David Bradley, Penn State University (Underwater Acoustic Propagation Modelling).

Abstracts are encouraged to be submitted in late March, with papers to be double blind peer reviewed by default. The event also represents an outstanding opportunity for industry to network and engage, with a detailed sponsorship prospectus now available.

More information: www.acoustics2017.com

Luke Zoontjens

Fellowships presented at the 2nd Australasian Acoustical Society Conference (Brisbane, November 2016)

Citation for: FASNZ to Stuart Camp

I first met Stuart when he was an undergraduate at the University of Auckland and, after completion of his university studies, he joined the ranks of Marshall Day Acoustics. Over the years at MDA, he has worked in – and even established – some of their offices in Kuala Lumpur, Melbourne, Wellington and finally Christchurch.

Early on, Stuart's energy and enthusiasm was directed to our society's journal, NZ Acoustics. It is a publication of which we can be particularly proud, providing not merely an organ for dry academic papers but which recognises that our membership includes consultants, engineers, marketing and sales personnel, and students as well – so has a recipe of having something for everyone. This includes Stuart's own humourous "Did I Say That?" column of bloomers culled from official documents and evidence statements in NZ, the occasional technical cryptic crossword and, something which I know is dear to Stuart, his famed Café and Restaurant Acoustical Index (CRAI) which provides a rating of eating and dining establishments in NZ based on users' subjective experiences of the noise levels and acoustics.

On the subject of Stuart's sense of humour I well remember how he presented (at one of our conferences in Wellington, if my memory serves me well) a paper in which he reported on a study of the flushing noise of different varieties of lavatory pedestals. This he presented under the title "A Study of Brown Noise" – not exactly what one might term a moving title but quite apt none-the-less. Stuart has, over the years, held at various times all the available positions for officers of the society: council member, Vice-President, Secretary and President as well as editor of NZ Acoustics. Beyond these, he has been instrumental either as Chair or prime organiser of some of our most successful conferences. Principal amongst these was Inter-Noise 98. Another notable first was the inaugural joint New Zealand and Australian Acoustical Societies Conference in 1997, organised with Stuart at the helm. Finally, our most recent NZ-only biennial conference in 2014.

I never imagined that, only 2 years later, I would hear that Stuart would be retiring. Congratulations Stuart on all the parts you have played in the society and thank you sincerely for all that you have given us. May we wish you a long, enjoyable and active future ahead. It is my great pleasure to welcome you now as the newest Fellow of the Acoustical Society of New Zealand.

by George Dodd
Fellow of the Acoustical Society of New Zealand, Senior Lecturer in Architecture, Engineering, Music and Audiology at University of Auckland and editor of the Journal of Building Acoustics.

Citation for: FAAS to Lex Brown

Professor Lex Brown has made an outstanding contribution to the field of Environmental Acoustics during a career spanning over 35 years. Born and educated in Australia, Professor Brown received a Bachelor of Engineering (Civil, Honours) in 1968, a Master of Urban Studies in 1975 and a PhD in 1979 from the University of Queensland. Subsequently, during his academic career, Professor Brown served as Dean, Faculty of Environmental Sciences at Griffith University, Brisbane from 2003 to 2006. Prior to that Professor Brown was Head of the Australian School of Environmental Sciences (1989 – 1994), and Foundation Head of the School of Environmental Planning, both at Griffith University. Visiting Professorships held by Professor Brown during his career include Tongi University, Shanghai; at the UNEP supported Institute of Environment for Sustainable Development; Bodenkultur University, Vienna; The University of Cape Town, South Africa; Institute of Sound and Vibration Research, University of Southampton.

To date, Professor Brown has been external examiner to 14 universities, a reviewer for 23 international journals and has supervised 27 higher research degrees and honours students, including 10 PhDs. Professor Brown has authored some 100 publications from his varied research interests, and has held numerous editorial positions on international journals, including Editor (Asia Pacific) of the Journal of Environment and Planning and Management for more than a decade.

During his career, Professor Brown has acted as a consultant and Advisor to a wide range of international organisations including WHO, UNDP, UNEP, IUCN, EU, UNESCO, various governments in the Asia-Pacific region, Australia, Europe, Bhutan, China, Pakistan, The Netherlands, Thailand, Southern Africa, Indonesia, the Philippines, Lesotho, Papua New Guinea.

In recognition of his experience, Professor Brown has been invited to serve as a member of the International Advisory Committee, Centre for Strategic Environmental Assessment of the Chinese University of Hong Kong, and as a member of an International Standards Organisation committee. As a Foundation Member of the Queensland Division of the Australian Acoustical Society (formed on 24 November 1985) and a member of the NSW Division prior to that, Professor Lex Brown has been a member of the Australian Acoustical Society for more than 30 years.

Claire Richardson MAAS
Managing Director, Air Noise Environment

EXPERIENCES FROM ACOUSTICS 2016

AAS/ASNZ Joint conference 2016

Acoustics 2016 held in the Brisbane Convention Centre, 9 to 11 November 2016. Below are reports from organisers and from recipients of travel awards to assist with their participation at the conference.

Acoustics 2016

The second joint Acoustical Society of New Zealand and Australian Acoustical Society conference, "Acoustics 2016", was held 9 to 11 November in Brisbane, Queensland. Aside from the pleasant venue and convenient, picturesque location, it was a lively atmosphere and an outstanding attendance at the presentations in five parallel sessions. These were held over the three days, covering topics including architectural acoustics, environmental noise and vibration, marine bioacoustics, acoustical practice and analysis and aeroacoustics. The four Plenary speakers were Associate Professor Christine Erbe, Associate Professor Tapio Lokki, Mark Bastasch and Claire Richardson. The keynote speakers were Dr Michael Kingan, Miklin Halstead, Associate Professor William L. Martens, Dr Rebecca Dunlop, Associate Professor Michael Noad, Chris Day and John Macpherson. There were also the invited speakers: Dr Danielle Moreau, Dr Norm Broner, Dr Christian Nocke, Associate Professor Paul Meehan, Tom Evans, Dr Luke Zoontjens, Ross Palmer, Dr Alec Duncan, James Whitlock, Sam Clarke and Chris Turnbull. The technical exhibition continues to grow each conference and for Acoustics 2016 were over 70 technical exhibitors. Three short courses - educational acoustics, sound perception and noise control hints and success - and two technical tours were held before the main conference commenced.

The social aspects were well covered with the welcome reception on the Wednesday evening and an enjoyable conference dinner on the Thursday evening, with comical and insightful speeches and award presentations.

A more comprehensive report and photos are expected for the April 2017 issue.

A Kiwi Perspective

The Convention Centre turned out to be an impressive venue, somewhat dwarfing our intimate acoustical conference with its vast array of exhibition halls and seminar rooms. Thursday's presentations opened with Tapio Lokki discussing "Why is it so hard to design a concert hall with excellent acoustics?" - an interesting and equally open-ended topic. This really set the high standard for the majority of papers presented over the next two days. Due to the combined contributions from the Australian, New Zealand and handful of international experts, a broad range of papers was presented, including (but certainly not limited to) acoustics in rooms, buildings and underwater, of wind turbines and legislation, and for educational spaces. Acoustics in educational spaces seemed to be a hot topic, particularly amongst the New Zealand contingent, egged on, I'm sure, by the significant capital expenditure promised by the NZ Ministry of Education over the next few years.

The Congress Dinner was excellent. The food, like all of meals provided by the venue, was exceptional. I particularly enjoyed George Dodd's rambling encomium, which struck up some good old fashioned trans-Tasman rivalry.

Friday saw more high-calibre papers, and as the final plenary speech drew to a close, I reflected that this joint conference was the perfect size. The breadth of papers spread over five streams ensured there was the right amount going to keep things interesting, but without feeling that I was missing out on too much. Being the second only joint AAS and ASNZ conference, the event was a huge success, leaving me inspired to commit that ever-precious time to research and write a paper for one of 2017's upcoming conferences. I'm going to go out on a limb and suggest that all of the ASNZ conferences should be jointly held with the AAS. It seems that acoustical issues facing both New Zealand and Australia are all but identical, and that perhaps our two great nations aren't so different after all.

Tim Beresford MAAS
Senior Associate / Acoustic Manager, Norman, Disney & Young

Meeting of Environmental Noise Officers

Following a tradition started at previous AAS conferences, an interagency regulators meeting was held during the Acoustics 2016 conference in Brisbane. Government noise policy and regulation representatives from Queensland, New South Wales, Victoria, South Australia, Western Australia Governments and Brisbane City Council and Auckland City Council, participated in an information sharing meeting. One or two retired members may also have gate crashed the meeting. The topics covered included noise policy reviews, noise regulation reviews, noise and town planning, residential encroachment on existing noise sources, accreditation of acoustic consultants, low frequency noise, helipads, frost fans and outdoor concerts and festivals. The meeting was very beneficial to all the participants with a lot of information being shared between the different jurisdictions.

Frank Henry
Brisbane City Council

NSW AAS Travel Grant Recipients

Paper: Some secrets of good musicians: the physics of controlling the articulation and timbre in reed instruments

I feel very grateful to the NSW division of the AAS for providing me the travel award to attend the Australasian Acoustical Societies' Conference for the first time, though I have been doing research in acoustics for years. This three-day conference was held at the giant and luxurious convention centre located at Southbank, Brisbane. The conference program was really extensive and covered all areas of acoustics, with several parallel sessions, workshops, technical tours and short courses. Not limited to scientific research, the presentations also included numerous industrial applications and technical practice with interesting topics in underwater acoustics, architectural acoustics, classroom acoustics, etc. It was definitely a great opportunity for me to meet colleagues in various areas of acoustics and know about their latest work. While the plenary and keynote talks provided excellent reviews of the progress in the important areas in acoustics over the last few decades. I also presented a short summary of the several projects during my PhD thesis: some secrets of good musicians: the physics controlling articulation and timbre in reed instruments. My presentation worked out very well and received a few positive suggestions and comments. Overall, I would say the conference was full of fun and helpful, not only because it provided me this opportunity to broaden my view of acoustics and to present my work to the experienced professionals in acoustics, but also it helped me to make friends and build up the network with colleagues. I believe that the great experience at this conference would further benefit my career in acoustics.

Weicong Li
UNSW

Paper: Classroom acoustic conditions: understanding what is suitable through a review of national and international standards, recommendations and live classroom measurement

Receiving an AAS NSW Early Career Research Travel Grant for the Acoustics 2016 conference was a fantastic opportunity for me to attend and present at the conference. I was fortunate enough to be invited to present at the Classroom Acoustics – How Innovative Learning Environments are Changing the Educational Playing Field short course. Innovative learning environments are a hot topic at the moment (and a somewhat controversial one). So this was a great opportunity to share my own research, and even more so to learn from the other fantastic presenters and experts working in this area. There was a lot of participation and discussion from the attendees at the short course. This enabled us to identify future areas to research and implement change to ensure these spaces are designed appropriately.

Receiving the travel grant also allowed me to write and present my own paper entitled Classroom acoustic conditions: Understanding what is suitable through a review of national and international standards, recommendations, and live classroom measurements and participate in a panel discussion on acoustics for educational spaces which generated a lot of discussion. I am very thankful for this exposure which has resulted in requests for my presentations and papers which will also raise the profile of the Australian and New Zealand Acoustical Societies. Attending the conference also allowed me to listen to other presentations and extend my knowledge in other areas of acoustics that I wouldn't normally get to hear about.

Another highlight of the conference was the social events which were a lot of fun and great opportunity to network and make new friendships. I have enjoyed staying in contact with these people since the conference. I hope to attend many more AAS Acoustics Conferences in the future!

Kiri Mealings
Macquarie University

Colin Speakman Student Travel Bursaries

Two Colin G Speakman student travel bursaries were presented at Acoustics 2016, by Colin's widow, Ms Kate Niland. The CG Speakman travel bursaries were established in 2012: however, this is the first time they have been awarded.

1. Cameron Milne, a MEng candidate at UQ Mechanical & Mining Engineering received a bursary for his ACOUSTICS 2016 paper Wear Simulation for Boundary Lubricated, Radially Loaded, Spherical Roller Bearings.

2. Jennifer Allen, a Phd candidate at UQ Cetacean Ecology & Acoustics Laboratory (CEAL) received a bursary to assist with travel costs associated with presentation of her paper entitled "Creation of an Acoustic Dictionary to Classify Vocal Repertoire of Humpback Whale Song" at the 5th Joint Meeting of the Acoustical Society of America and the Acoustical Society of Japan, Honolulu, Hawaii, 28 November – 2 December 2016. Miss Allen was awarded a bursary of up to $1200 towards her costs and at the invitation of the ACOUSTICS 2016 organising committee and the Queensland Division attended the Thursday sessions of ACOUSTICS 2016 and the Conference Dinner for the presentation.

Qld Division

The other Queensland Bursary presented at the dinner, was to Adrian O'Shea, a 3rd year mechanical engineering student at QUT: Adrian was awarded the Acoustics Bursary ($2000) in July 2016 for his project Pipeline and Pump Condition Monitoring Using Acoustic Emission. Acoustics Bursary awardees are invited to present a paper based on their project at the annual conference of the Society and receive additional funds towards conference delegate costs, if they choose to do so. Adrian's paper Design and numerical analysis of a test-rig for the study of pipe-leak generated acoustic emissions was presented at ACOUSTICS 2016.

ACOUSTICS NEWS

NSW Wind Energy Framework

The NSW Government's Wind Energy Framework has been released by the Honourable Rob Stokes, Minister for Planning. It is designed to provide greater certainty and consistency for industry, peak bodies, government and local communities regarding the assessment and regulation of large scale wind energy projects.

The framework will help the NSW Government maximise its contribution to the Commonwealth renewable energy target for 2020.

More information: Meagan Kanaley, Principal Planning Officer, Industry and Infrastructure Policy. Tel: 02 9274 6134. http://www.planning.nsw.gov.au/Policy-and-Legislation/Renewable-Energy

3D view of a model city

THE first in a series of detailed and highly accurate interactive 3D models of Australian cities has been released in South Australia.

Aerial mapping company Aerometrex took thousands of high-resolution photographs from a helicopter over Adelaide's CBD to develop the interactive city model.

Aerometrex Technical Director David Byrne said taking higher resolution photographs and more of them helped achieve a greater level of detail than other 3D modelling, such as Google Maps. Also, the use of automatic processing software rather than traditional hand-digitised methods allowed for greater detail.

"We're modelling everything from street furniture to trees and parked cars - it's a very comprehensive data set and much more life-like."

"Using intersecting rays of light we create lots of 3D points then we join all of those points together to create a mesh and we place the original imagery back over that mesh to give it a realistic look."

More information: http://aero3dpro.com.au/, david.byrne@aerometrex.com.au.

WORKPLACE NOISE & VIBRATION

NIOSH in the USA has placed an Engineering Controls Database on its website. It contains descriptions of controls, effectiveness summaries, and schematics of engineering control technology evaluated by NIOSH during laboratory and field investigations. Numerous entries relate to workplace noise.

NIOSH has also recently published an assessment report on Noise, Vibration and Heat Assessment and Control in a Hammer Forge Company - see: http://www.cdc.gov/niosh/hhe/reports/pdfs/2007-0075-3251.pdf

Long-time acoustic consultant and policy advisor, Alice Suter, has recently completely a review report for NIOSH on intermittent noise and NIHL - The Relationship of Non-Gaussian Noise to Noise-Induced Hearing Loss. It also contains a discussion on research into "hidden hearing loss". It is not yet published on-line, but if anyone is interested in reading it contact Pam Gunn at pam.gunn@commerce.wa.gov.au

A Boston group of researchers, led by Charles Liberman, has recently published on the development of a differential diagnosis of hidden hearing loss in humans. See: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5019483/pdf/pone.0162726.pdf This important work could lead to evidence that damage to the hearing process can occur at levels well below the current exposure standards for occupational noise.

The Institute of Noise Control Engineering of the USA has recently published two useful workshop reports. The first, Reducing Employee Noise Exposure in Manufacturing: Best Practices, Innovative Techniques, and the Workplace of the Future is at: http://inceusa.org/Reports/TQA_EmployeeExposureMfg_2016.pdf In particular the case studies at electronic pages 71, 75, 99, 105, 113, and 115 are of interest. The second, Engineering a Quieter America: Progress on Consumer and Industrial Product Noise Reduction is at: http://inceusa.org/Reports/TQA_EngrQuieterAmerica_2016.pdf. The Industrial Product information is from page 62 on, but leaf blowers (p37) and IT equipment (p45) may also be of interest to people in workplaces.

Also in the USA, the Department of Labor has recently held a Noise Challenge competition to design new technology that overcomes barriers in work-induced hearing loss prevention. The finalists and winners can be viewed here: https://www.dol.gov/featured/hearing/#finalists

Information on how to select a safe blow-gun, including noise consideration, is available in 2 videos and a fact sheet from the Canadian IRSST at: https://www.irsst.qc.ca/en/headlines/id/379/what-is-a-safe-blow-gun-how-to-select-one?utm_source=all&utm_campaign=2016-09%20infoirsst%20en%20externe&utm_medium=email

The IRSST has also published a report Reproduction of industrial sound environments for applications to study audibility of alarms and other sound signals for health and safety: proof of concept. See: http://www.irsst.qc.ca/en/publications-tools/publication/i/100896/n/environnements-sonores-industriels-audibilite-alarmes- They will now be able to carry out further research on the perception and localization of alarms and other audible warning devices, which are important for occupational safety in the workplace.

A new paper by USA university researchers on WBV and truck

drivers' health has been published. The results demonstrate that using the daily vector sum value in calculating the A(8) exposures may be better than using the predominant z-axis value; that lower back pain was the main physical health effect and that health status decreased as WBV exposures increased; and finally, seat manufacturer and seat age were two factors which had a strong influence on WBV exposures. See: http://annhyg.oxfordjournals.org/content/60/8/936.full.pdf+html

A South Australian court case has held that, on the balance of probabilities, a connection has been established between a worker's use of a headset for work (he was a network administrator for a computer company) and the tinnitus he suffers from. It also explains the differences between the standard of proof required in law and that in scientific research. See: http://www.austlii.edu.au/au/cases/sa/SAET/2016/59.html

An interesting article on The Sound of Fear has been published in The Conversation by a Queensland University of Technology PhD candidate. http://www.abc.net.au/news/2016-10-08/the-sound-of-fear/7913512 It includes a discussion on long-range acoustic devices for crowd control.

Research projects to understand hearing loss and tinnitus mechanisms and to eventually to find cures are funded by the UK charity Action on Hearing Loss. The latest information on their projects from around the world can be found at:

https://www.actiononhearingloss.org.uk/your-hearing/biomedical-research/projects-and-research.aspx

Chuck Kardous of NIOSH has published a follow-up to his previous work on assessing Smart phone apps for noise measurement http://dx.doi.org/10.1121/1.4964639. In this, he shows that by using calibrated external microphones, an accuracy of +1 dB can be obtained when measuring steady-state pink noise.

An ergonomics research group from the University of Saskatchewan in Canada has been studying the risk factors for Lower Back Disorders in Farmers. Their published work on WBV measurements can be found here: http://www.tandfonline.com/doi/abs/10.1080/00140139.2016.1252859 ; and a detailed MSc thesis here: https://ecommons.usask.ca/handle/10388/7389.

The same group is planning a study on WBV and Fatigue, see: http://research-groups.usask.ca/ergolab/our-research/whole-body-vibration-simulation.php

Pam Gunn has contributed these Workplace Noise and Vibration items.

Listen UP! Europe's First Hearing Conservation Conference

Hosted in March 2016 by HSE's Health and Safety Laboratory, Listen Up! was the first truly multidisciplinary conference for Europe to focus on preventing harm from exposure to noise at work. Listen UP! sought to unite all parties with an interest in hearing conservation and to facilitate the sharing of experience, expertise, advice and solutions. It attracted employers, consultants, occupational health professionals, audiologists, product and service providers, charities, academics and other government departments.

The audience benefited from a day of stimulating and informative talks from a range of international experts. The day started with an overview of the problem and a case for change with keynote talks from HSE's Chief Scientific Adviser, charities and insurance companies.

The afternoon explored the makings of a modern hearing conservation programme. Delegates heard about the evidence base for interventions to prevent occupational hearing loss, issues in buying quiet machinery, and how to achieve positive attitudes towards noise with a behaviour change programme that has already proven successful in the US: Dangerous Decibels. The talks provided practical advice and examples across a number of sectors of how to take steps to improving management of noise risks.

Case studies from Akzo Nobel in Holland and Anglo Ashanti Mines in South Africa supplemented the day providing real world insight and experience on the impact positive preventative action can have.

The event was a great success in uniting professionals and interested parties who share a common goal, and delivered real food for thought. It provided a fantastic platform for the forging of new relationships and enabling new concepts to be taken back to the workplace.

A key outcome of Listen UP! has been the involvement of a number of participants in contributing to the Great Britain Action Plan on Hearing Loss – a cross-system plan to tackle hearing loss from a number of perspectives including, crucially, prevention. The group focussed on prevention for this plan has built on the foundations of the Listen UP! event and is now taking forward opportunities to pilot Otoacoustic Emissions Testing in occupational settings and also bringing the Dangerous Decibels education scheme to the UK. More information on this action plan is available from https://www.england.nhs.uk/wp-content/uploads/2015/03/act-plan-hearing-loss-upd.pdf and emerging work on prevention through the NHS England Action Plan on Hearing Loss is available from clare.forshaw@hsl.gsi.gov.uk

All in all exciting times ahead in the UK, and clearly an example of how, by working together across disciplines and looking to learn internationally from best practice, we can start to make real progress and make that difference!

Clare Forshaw is the Head of the Centre for Health at HSE's Health and Safety Laboratory.

Acoustics Forum

IMPROVING NOISE MODELLING ACCURACY WITH OBSI ROAD SURFACE CORRECTIONS

Antony Williams[1], Dominic Sburlati[2]

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Preamble

This forum letter summarises preliminary studies for the derivation and application of road surface corrections for noise modelling using on On-Board Sound Intensity (OBSI) measurements. It is based on a measurement system and results that were the topic of research papers presented at the Australasian Acoustical Society conferences *Acoustics 2015* (Hunter Valley) [1] and *Acoustics 2016* (Brisbane) [2]

Introduction

The prediction of road traffic noise using noise models is a common feature of Environmental Assessments and Development Applications. The outputs of noise models are used to determine the noise mitigation requirements for a project, which can amount to up to several million dollars on large projects. It is therefore important to have reliable modelling results which adequately represent a project's impacts and that correlate well with noise levels measured in the real world.

Road traffic noise is usually modelled in Australia by applying 'standard' road surface corrections that are based solely on the pavement type in question. The 'standard' pavement correction in NSW for low noise pavements such as Open Graded Asphalt (OGA) or Stone Mastic Asphalt (SMA) is taken to be a generic -2 dB adjustment [3] defined relative to Dense Graded Asphalt (DGA), even though pavement performance is known to change over time, depending on usage and wear rate.

SLR has recently designed, manufactured and successfully tested a dedicated 3D printed OBSI system for measuring tyre-pavement noise at source. The OBSI system was constructed with reference to AASHTO TP7613 [4] and uses microphones mounted to a test vehicle wheel, in a sound intensity probe configuration located in the vicinity of the tyre-pavement contact patch. Real time sound intensity measurements are taken whilst the test vehicle drives along a pavement of interest. Some of the 3D printed components are shown in Figure 1.

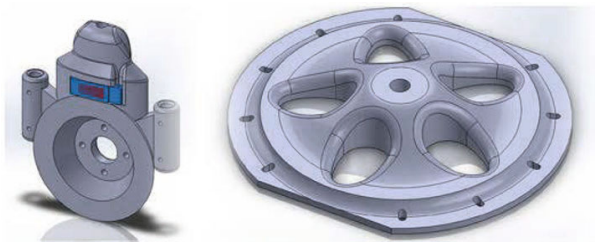


Figure 1. 3D printed components of the OBSI system

A key aim of developing this OBSI system was to assist in improving the accuracy of noise modelling for road infrastructure projects in Australia by including a site specific road surface correction factor based on measured data. Further investigation works to test the

concept were therefore recently conducted to determine OBSI road surface corrections and their effect on noise modelling.

OBSI Testing Methodology

The system uses two side-by-side phase matched microphone pairs connected to a data acquisition system. The dual microphone data is post processed and combined with simultaneously captured GPS and speed data via an in-house developed computer algorithm, which allows geo-referenced mapping of road surface intensity for the length of the road being tested. The noise levels and corresponding road surface corrections are outputted at intervals of 1 second, with corrections being able be determined independently for both carriageways, or even for individual lanes if necessary.

The tyre used in OBSI measurements is a key component of the system and the test tyre for the study was therefore selected with reference to the requirements of ASTM F2493-08 [5]. Whist the 'Standard Reference Test Tyre' detailed in the standard was unable to be locally sourced, a Yokohama ASPEC A349 was selected based on comparable features such as tread pattern, stiffness and tyre construction. The pressure and hardness of the test tyre were checked against the requirements of the standard prior to testing.

Determination of Road Surface Corrections

OBSI measurements were conducted for a 28 km section of the M4 Motorway in Sydney, for which the road surface is understood to be OGA, although its age and condition varies significantly. Three measurements were made in the left-most lane of each carriageway direction and the data was averaged. During all measurements the vehicle load consisted of two people and the on-board OBSI instrumentation.

The road surface corrections derived from the OBSI system are relative to OBSI and Controlled Pass-By (CPB) measurements undertaken at a two 'reference' test sites which had recently resurfaced DGA in good condition.

The 'OBSI road surface corrections' are shown in Figure 2 for the eastbound carriageway of the motorway.

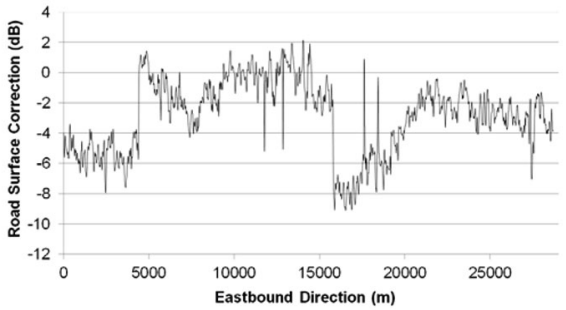


Figure 2. Measured OBSI road surface correction

It is observed that the OBSI road surface corrections for the test section vary between approximately +2 dB and 9 dB. The measured surface correction is seen to deviate significantly from the 'standard' 2 dB NSW adjustment factor for OGA, with certain sections performing significantly better than 'standard', whilst other sections perform significantly worse. The data also shows that there are two locations where large step changes, in the order of 6 dB, are apparent. These are locations where the surface type abruptly changes from what appears to be worn OGA to relatively newly resurfaced pavement.

This measured OBSI data was applied to a noise model of the same area and referenced to noise monitoring data at a number of receiver locations adjacent to the motorway. The results from this study are the topic of a paper recently presented at the Acoustics 2016 conference [2] and are investigated further here.

Noise Modelling Results

The OBSI measured road surface correction factors for the motorway were applied to road strings in a noise model of the study area with a node spacing of 10 m. The eastbound and westbound carriageways were modelled individually.

Noise monitoring adjacent to the study area was undertaken at a number of locations on a recent road infrastructure project. Noise levels were predicted to the noise monitoring locations using a noise model which implemented the Calculation of Road Traffic Noise (CoRTN, 1988) algorithms [6]. Two scenarios were modelled – one making use of 'standard' OGA road surface corrections and one using the high resolution OBSI measured surface corrections. Noise predictions were undertaken using concurrently measured traffic data for the 11 am to 3 pm period and compared to the measured noise level data during the same period. This period was used as it is known to be free flowing and therefore not affected by traffic congestion.

Nine noise monitoring locations were selected from the dataset for comparison, and are shown in Figure 3. Locations were used that typically had unobstructed views of the main motorway carriageway and were not near features such as adjacent roads or garden fences. Setback distances of the monitoring locations were typically around 20 m to 50 m from the carriageway.

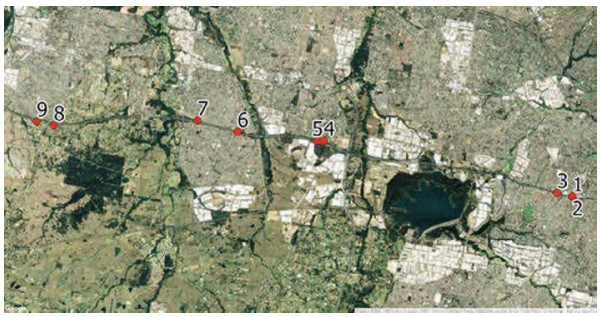


Figure 3. Noise monitoring locations

The noise modelling results using the 'standard' corrections in comparison to the OBSI derived road surface corrections are summarised in Table 1 and Figure 4.

ID	Noise Level (dBA)				
	Measured	'Standard' Corrections		OBSI Corrections	
		Predicted	Difference	Predicted	Difference
1	59.6	61.3	1.7	60.8	1.2
2	69.1	72.5	3.4	72.0	2.9
3	77.3	77.8	0.5	77.3	0.0
4	57.7	60.2	2.5	58.9	1.2
5	78.0	74.5	-3.5	75.6	-2.4
6	77.3	74.9	-2.4	76.3	-1.0
7	61.4	59.9	-1.5	60.9	-0.5
8	64.1	65.8	1.7	64.0	-0.1
9	57.6	62.5	4.9	59.8	2.2
		Median	1.7	Median	0.0
		Average	0.8	Average	0.4
		Std Dev.	2.8	Std Dev.	1.7

Table 1. Noise modelling summary – 'Standard' vs OBSI road surface corrections

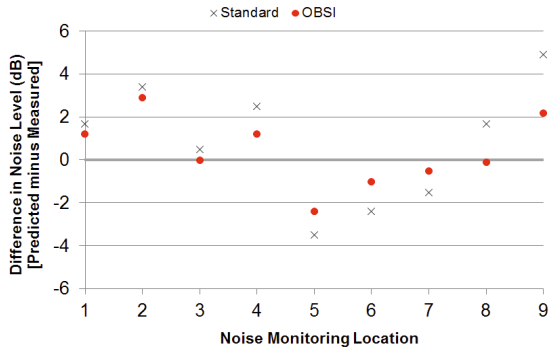


Figure 4: Comparison of 'Standard' vs OBSI road surface corrections

The results indicate that the use of OBSI road surface corrections has increased the accuracy of the noise model. The median error has been reduced from 1.7 dB using 'standard' corrections to 0.0 dB using OBSI corrections, with the average difference being reduced from 0.8 dB to 0.4 dB. The standard deviation of the dataset has also been improved from 2.8 dB to 1.7 dB. The predicted noise level at all nine noise monitoring locations is closer to the measured level using the OBSI corrections.

Noise models will commonly produce acceptable errors of around 2 dB (ENMM, 2001) [7]. However as this study indicates, roads which have particularly worn or old pavement surfaces can have significantly higher and more variable noise emissions than the 'standard' road surface corrections allow for. Similarly, new sections of low noise pavement appear to perform significantly better than is typically assumed. With consideration of this through the use of OBSI measured road surface corrections, the majority of the predicted noise levels in this study are now within, or significantly closer to, the accepted accuracy of noise modelling.

Whilst this preliminary study indicates that there is value in incorporating the measured road surface emissions into noise models, there are a number of areas that may need further investigation. This study, for example, applies the road surface correction factors as measured in the nearside lane to all lanes of a carriageway direction. Whilst this appears to have been an appropriate assumption for this study, there may be situations where the road emission characteristics for adjacent lanes are notably different due to factors such as pavement age or wear rate. Individual road surface corrections for each lane are able to measured using the OBSI system if required, and this coincides with the recent move in NSW to modelling all trafficable lanes individually for large infrastructure projects.

Whilst this study and previous investigations [8] have concluded that wayside noise levels can be effectively predicted based on OBSI data, it is noted that the influence of site-to-site variation can have a significant effect on noise propagation at distance. Previous studies [8] have applied site specific normalization factors based on data from concurrently measured CPB and OBSI data to establish better correlation with at-source measurements and wayside noise levels and it is recommended that further investigation into this is completed to better understand how this relates to Australian conditions.

Further investigation is also required in relation to the use of DGA as the 'standard' reference pavement, as there is known to be significant variation in the performance of DGA depending on pavement age and condition [9]. Source measurements of a wide range of DGA surfaces would provide better understanding as to the range of emission levels and characteristics.

Acknowledgements

The authors would like to thank Tom Cockings of Waves Consulting and Matthew Harrison of Pulse Acoustics for their significant input in to the OBSI study.

References

[1] Cockings, T, Sburlati, D, and Harrison, M 2015, *OBSI Measurements for the Purpose of Calibrating Road Surface Corrections for CoRTN Based Road Models*, Proceedings of Australian Acoustical Society, 2015, Hunter Valley, Australia.

[2] Williams, A, Sburlati, D, Harrison, M 2016, *Using OBSI Measurements of Road Surface Corrections to Improve Noise Modelling Predictions*, Proceedings of Australian Acoustical Society, 2016, Brisbane, Australia.

[3] Roads and Maritime Services 2016, *Noise Validation Guideline (NVG)*

[4] American Association of State Highway and Transportation Officials (AASHTO) 2013, *Standard Method of Test for Measurement of Tyre/Pavement Noise Using the On-Board Sound Intensity (OBSI) Method*

[5] ASTM F 2493 2008, *Standard Specification for P225/60R16 97S Radial Standard Reference Test Tire.*

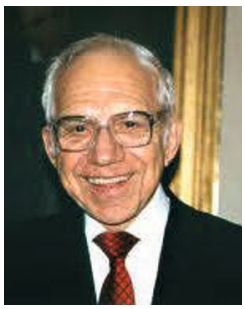
[6] Department of Transport, Welsh Office 1988, *Calculation of Road Traffic Noise (CoRTN)*.

[7] Roads and Traffic Authority of New South Wales 2001, *Environmental Noise Management Manual (ENMM)*

[8] National Cooperative Highway Research Program 2009, *Measuring Tire-Pavement Noise at the Source (Report 630)*

[9] Parnell, J, Samuels, S, 2016, *A Comparison of Tyre/Road Noise Generated on NSW Pavements to International Studies*, Proceedings of Australian Acoustical Society, 2006, Christchurch, New Zealand.

OBITUARIES



Leo Beranek

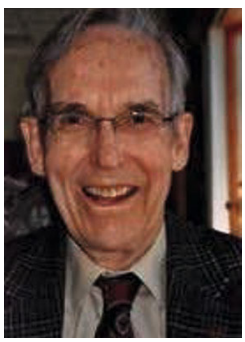
Leo Beranek died in Westwood, Massachusetts, on October 10, 2016 at age 102 after a long and extraordinarily productive life. He leaves his wife Gabriella, sons James K. Beranek and Thomas B. Haynes and granddaughter, Antonia Hsu Haynes. He was predeceased by Phyllis Knight Beranek, his wife of 42 years.

A 1936 graduate of Cornell College (Iowa) with a B.A. degree in Physics and Mathematics, Beranek went on to graduate school in the Applied Physics Department of Harvard University where he received his D. Sc. Degree in 1940 in the field of acoustics. Beranek stayed at Harvard during World War II as Director of two laboratories; first the Electro-Acoustic Laboratory, which dealt with voice communication in combat vehicles, and then the Systems Research Laboratory, whose mission was to improve the U. S. Navy's ability to combat Japanese Kamikaze aircraft attacks. At the war's end, President Harry S. Truman issued Beranek a "Certificate of Merit" for his contributions to the war effort. After WWII, Beranek became Associate Professor of Communication Engineering at the Massachusetts Institute of Technology where he taught courses in electrical engineering and acoustics. His seminal textbook, ACOUSTICS, was published in 1956, forever changing the teaching of acoustics to engineers.

In 1948, the acoustical consulting firm Bolt Beranek and Newman was formed with Beranek as President. Its first projects were the acoustics and sound systems in the United Nations buildings in New York, followed by NASA's jet engine test facility in Cleveland. Beranek designed and saw built the world's largest acoustic muffler, which was featured in LIFE magazine (6/11/51). In 1965, under Beranek's leadership, BBN became the vanguard of the digital age by putting together one of the best computer software groups in the East and by 1971, BBN invented e-mail with "@" as we know it today. Beranek left BBN in 1969 to become President of Boston Broadcasters Inc. After his foray into broadcasting, Beranek returned to acoustics. Among others, he consulted on five concert halls and an opera house in Japan. Among them was the Tokyo Opera City Concert Hall, which was hailed as an "acoustical 'miracle'" on the front page of the New York Times [4/18/2000]. The Hall, which opened in September 1997, is now considered one of the five best concert halls acoustically in the world. During this same period, he published two additional books, Concert and Opera Halls: How They Sound (1996), and Concert Halls and Opera Houses: Music, Acoustics and Architecture (2004).

Beranek published 185 technical papers and thirteen books, including Noise and Vibration Control Engineering (with co-author) (Wiley 2006) and Acoustics: Sound Fields and Transduxers (with co-author) (Elsevier 2014). Beranek served the Boston Symphony Orchestra as a member and chairman of the Board of Overseers and later as member and Chairman of the Board of Trustees (1968-1988). He was fulltime president of the American Academy of Arts and Sciences for five years. The alumni of Harvard University voted him a member of their senior governing body, the Board of Overseers, for six years, He also served as President of the Acoustical Society of America and the Audio Engineering Society.

Beranek has been awarded with many honors, awards and honorary doctorates in Europe and the United States of America. Leo Beranek has also been a great contributor to AAS-related activities. In his late 90s, he travelled to Sydney to participate in the ICA 2010 and he continued on to Melbourne to participate in the satellite congress on room acoustics. During his time in Australia, he was presented with an ICA Award for outstanding contributions to acoustics and he was made an honorary fellow of the Australian Acoustical Society.

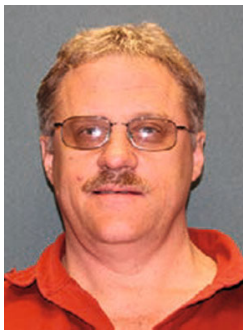


Bill Lang

It is with great sadness that we advise William (Bill) W. Lang passed away on 23 October 2016 at the age of 90. Bill suffered a stroke on October 13th just after attending a workshop in a series of workshops following up on the "Technology for a Quieter America" - an effort that he was so instrumental in developing, advocating, and advancing.

Bill held a special place for noise control internationally. He was the founding member of I-INCE, a director 1975 to 1987 and then served as President 1988 to 2000 and remained on the Board of Directors up until this time. He will also be remembered for his involvement in International noise policy along with George Maling and Tor Kihlman. He was tireless and ever optimistic in his pursuit of Noise Control Engineering and shaping national and international policy to advance the application of this technology.

He will be missed greatly by those who worked with him, those that knew him, those who followed his efforts to affect a quieter world. A link to Bill Lang Obituary is available at http://iince.org/files/links/Poughkeepsie%20Journal.pdf and an oral history at https://www.aip.org/history-programs/niels-bohr-library/oral-histories/29970



David Bartel

David W. Bartel received a B.App.Sc. (Exploration Geophysics) degree from Curtin University in 1982 and a Grad.Dip.App.Math. degree from Murdoch University in 1988. In 1996 he joined the Defence Science and Technology Group (previously DSTO) Edinburgh, South Australia, where his interests were underwater acoustic communication, sonar signal processing, underwater acoustic propagation modelling, and hydrophone time series synthesis. In 1999 he completed a M.Ma. Sc. (Sig. and Info. Proc.) degree at the University of Adelaide, and in 2006 he completed a Ph.D. (Elect. Eng.), also at the University of Adelaide, where his thesis topic was Decision-feedback equalisation with fixed-lag smoothing in nonlinear channels. David had key roles undertaking research and analysis in support of Royal Australian Navy platform and system acquisition projects and operational capabilities. In these roles, David provided expert scientific support and know-how developing and analysing advanced underwater sensing and communications systems. David was a valued and highly skilled member of staff who played important roles in shaping the direction of DST Group's research, developing advanced science capabilities and using these capabilities to help meet Australian Defence requirements. He was well liked and highly respected by staff and made many vital contributions to science programs and projects undertaken by his work area. David sadly passed away whilst bicycle riding, less than a week before the AAS/ASNZ annual conference in Brisbane, which he planned to attend and participate in.

Book Reviews

Handbook of Materials for String Musical Instruments

Voichita Bucur

Springer, New York, 2016

975 pages. Hardcover approx A$503, e-book approx A$421

I actually saw this book first in near-final draft form and was asked by the author to send a brief review to the publishers. This I was happy to do, and the publishers decided to place my summary review on the back cover of the published version. Now I have received a copy of the published book which has been enhanced by inclusion of many full-colour illustrations, and the present review refers to this final version.

The author spent more than 25 years of her research life in France, working on Forestry and wood products, before coming to Australia, where she has been a Senior Visiting Fellow with CSIRO in Melbourne since 2006. She has published more than 140 papers and three books with Springer before this one, a particularly notable one being *Acoustics of Wood*.

As its title indicates, the present book is not concerned solely with wood for musical instruments, though wood is the dominant material, but there is also consideration of composite materials which are being used for parts of some modern instruments. There is also a broad presentation of the history and evolution of string instruments and of the materials from which they have been or are made. While most presentation refers to members of the violin family, there is also consideration of guitars, harps and pianos.

The material from which they are made has more influence on the sound quality of string instruments than of any other group, with the possible exception of percussion instruments. Much of the book is therefore concerned with the structure and properties of various wood species and the ways in which they can be prepared, put together, maintained and repaired. All these topics are of both general interest to all those involved in making, playing or repairing instruments, and also to those simply interested in listening.

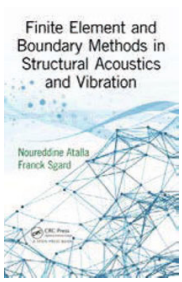
The presentation of the book is ideal for all those groups. There are many colour photographs of classical instruments, either as a whole or in structural detail, along with microscopic images of the cell structure of various woods and a discussion of the relation of this structure to acoustic properties. Even things like the varnish used by violin makers are discussed, partly in relation to the doubtful tradition about Stradivari violins and the reason for their supreme quality.

Presentation in the book also extends to discussion of the growth and harvesting of trees, the use of decorative timbers such as mahogany for the cases of grand pianos, the making of violin bows and piano hammers. There is also discussion of modern developments such as that of the "violin octet", which includes instruments an octave higher than a standard violin and a fourth lower than a standard double bass, together with the four-instrument guitar quartet developed in Australia and made popular by the group *Guitar Trek*.

The book is very well written and is in a format that allows you to open it at a random page and enjoy reading about the topic described there without having read the previous pages of that chapter. The references at the end of each chapter are extensive and there are various tables giving summaries of the information found from studies of particular materials or instruments.

The book is available in both hard-copy and electronic versions. My own preference is for the hard-copy version, perhaps because I am old-fashioned, but some may prefer the e-book version because of its easy portability. In either case, I recommend the book most highly for both content and readability.

Neville Fletcher



Finite Element and Boundary Methods in Structural Acoustics and Vibration

Authors Noureddine Atalla and Frank Sgard,

CRC Press, 2015. ISBN 978-1-4665-9287-2

"Finite Element and Boundary Methods in Structural Acoustics and Vibration" is a textbook on computational vibroacoustics where the interaction of sound waves and vibrating structures is treated using finite element (FE) and boundary element (BE) methods. It is suitable for graduate students who have a working understanding of FE and BE methods and who wish to investigate acoustic and vibration phenomena of structures. This also implies a

working understanding of Vector Calculus.

The first chapter gives an overview of the concept of vibroacoustics, the conceptual tools required in treating it and a brief overview of the book. The second chapter introduces the basic equations governing structural acoustics and vibrations. Then the third chapter goes on to present the integral formulations, the principles of virtual work and minimum potential energy, which are essential concept in modelling any continuum problem. Chapter four introduces the finite element method, both for discrete and continuous systems, how interpolation functions are implemented to define elemental matrices and how they are assembled to form a mesh of elements with example code written in Matlab. Chapter 5 goes through the solution process of uncoupled structural and vibration problems, analytically and with sample Matlab code. Interior coupling is presented in chapter 6. The Boundary Element Method (BEM) is presented in chapter 7 before exterior coupling is presented in chapter 8 with FEM-VBEM (Variational BEM). No Matlab code is provided in this chapter, the reader is referred to specialized solvers such as IDEAS© and MSC Nastran©. Overall, "Finite Element and Boundary Methods in Structural Acoustics and Vibration" is a thorough textbook in its field aimed at postgraduate studies, not for the faint-hearted vibrations novice, as it contains a vast amount of analytical derivations and programming. Prior familiarity with FEM, BEM and Matlab is highly advisable to the interested reader aiming at implementing these methods.

Murat Tahtali, PhD - Murat Tahtali is a Senior Lecturer in the School Engineering and Information Technology at the Canberra campus of the UNSW Australia

New Products

SoundSoup iPad App

The SoundSoup iPad App, which allows you to hear sounds in a room that you can d esign now has a FREE version, with all the features you need for basic use, including demonstrating your acoustic designs. There is also a PRO version that gives you access to reverberation and sound level data, saves audio files for later reproduction and more.

More information: Rob Bullen and Wendy Tufts +61 (0)407 461 100 info@stirfrysoftware.com www.stirfrysoftware.com http://www.youtube.com/channel/UClXzuKQwE_pCF3dtlGR5O-g

New Ground Vibration Monitoring Terminal Available

Brüel & Kjær has released its new ground Vibration Monitoring Terminal Type 3680, which enables users to effectively protect against structural damage risks, assess human response to ground-bourne vibration and monitor background vibration.

The simple-to-use unit provides uninterrupted, real-time vibration level measurement and automatically delivers alerts to avoid breeching set limits, as well as providing reports proving regulatory compliance.

The flexible Vibration Monitoring Terminal also reliably assesses vibration impact from traffic, can conduct background vibration surveys as well as evaluate vibration mitigation techniques. The self-contained unit contains sensor conditioning, processing, storage, wireless and 4G communication. Its rugged aluminium enclosure is water and dust proof to an IP67 rating.

More information: Bruel & Kjaer Australia auinfo@bksv.com or +61 2 9889 8888

New blasting monitor from SYSCOM

The MR3000BLA is a new instrument dedicated to the monitoring of explosion-induced vibrations from blasting, mining and quarrying. The MR3000BLA is an all-in-one autonomous device built into a rugged case for field measurements. The three channels for vibration and the channel for air overpressure make it perfect for blast monitoring.

The MR3000BLA can be linked with the new SCS (SYSCOM Cloud Software) to provide a real-time reporting solution with graphical norm comparisons.

More information: SAVTek Pty Ltd +61 (0)7 3300 0363 or +61 (0)487 954 022 enquiry@savtek.com.au

Future Conferences

Acoustics 2017 Perth

The annual AAS conference in 2017 will be in Perth from 19 - 22 November, at the Pan Pacific Hotel in the heart of Perth CBD. The theme is Sound, Science and Society.

Key dates:

Call for Abstracts	31 January 2017
Abstract Submission Deadline	10 May 2017
Registration opens	31 May 2017
Finalised paper submission	20 September 2017

More information: www.acoustics2017.com

ICBEN 2017

The 12th ICBEN congress on Noise as a Public Health Problem will be held June 18-22, 2017 in Zurich, Switzerland. The congress will take place on the campus of ETH Zurich (the Swiss Federal Institute of Technology) in the very heart of the city.

ICBEN 2017 welcomes contributions from the following fields: Noise-induced hearing loss, Noise and communication, Non-auditory health effects of noise, Effects of noise on cognition, performance and behavior, Effects of noise on sleep, Community response to noise and noise annoyance, Noise policy and economics, Noise exposure assessment in health effect studies and Special topics related to noise effects.

Abstracts due 31 January 2017.

The congress is organized under the auspices of ICBEN, by the Swiss Acoustical Society (SGA-SSA), in collaboration with the Federal Office for the Environment (FOEN), the Swiss Federal Laboratories for Materials Science and Technology (Empa), and the Swiss Tropical and Public Health Institute (Swiss TPH).

More information: http://icben2017.org

WTN2017

The seventh conference of the series will be held on May 2-5, 2017 in Rotterdam, in collaboration with TU Delft and supported by NAG (The Acoustical Society of the Netherlands) and NSG (The Dutch Noise Abatement Society). There is no obvious platform for debate on Shadow Flicker from turbines. Much of the basis for assessment is 20 to 30 years old. So, as a trial, WTN2017 will be accepting papers on shadow flicker potentially with also a small poster section of the conference on the subject. The list of abstracts of papers to be presented is available on the website. Registration will be available from Jan 2017.

More information: www.windturbinenoise.eu

INTER-NOISE 2017

The 46th International Congress and Exposition on Noise Control Engineering, 'Taming Noise and Moving Quiet" will be held in Hong Kong 27 to 30 August 2017. The Congress is organised by the Hong Kong Institute of Acoustics and the Hong Kong Polytechnic University, in conjunction with NVH Branch, Society of Automotive Engineering China and the Acoustical Society of China. INTER-NOISE 2017 will provide the opportunity for engineers and scientists in all fields of acoustics to learn about and share their work with colleagues from around the world. More than a hundred technical sessions will be arranged for exchange of views and sharing of experience.

The conference will be held in the Hong Kong Convention and Exhibition Centre. Framed by Hong Kong's skyline, HKCEC is a magnificent, multi-use venue located right in the heart of Hong Kong on its famous Victoria Harbour.

Key dates:

Abstract submission deadline	31 March 2017
Early bird registration deadline	28 April 2017
Optional peer review deadline	1 May 2017
Paper submission deadline	31 May 2017

More information: www.internoise2017.org

ICSV24

Abstract submission and registration is now open for the 24th International Congress on Sound and Vibration to be held in London from 23 – 27 July 2017.

Key dates:

Registration
Deadline for Early Registration - 31 March 2017

Submission of abstracts and full papers
(Peer-reviewed papers)
Deadline for Full-Length Paper Submission: 31 January 2017
Notification of Acceptance of Full-Length Papers: 15 March 2017

(Non-peer reviewed)
Notification of Acceptance of Abstracts: 25 February 2017
Deadline for Full-Length Paper Submission: 31 March 2017

More information: http://www.icsv24.org/

Sustaining Members

The following are Sustaining Members of the Australian Acoustical Society.
Full contact details are available from http://www.acoustics.asn.au/sql/sustaining.php

3M AUSTRALIA
www.3m.com

ACOUSTIC RESEARCH LABORATORIES
www.acousticresearch.com.au

ACOUSTICA
www.acoustica.com.au

ACRAN
www.acran.com.au

ACU-VIB ELECTRONICS
www.acu-vib.com.au

ADAMSSON ENGINEERING
www.adamsson.com.au

AERISON PTY LTD
www.aerison.com

ARMSTRONG WORLD INDUSTRIES
www.armstrongceilings.com.au

ASSOCIATION OF AUSTRALIAN ACOUSTICAL CONSULTANTS
www.aaac.org.au

BORAL PLASTERBOARD
www.boral.com.au/plasterboard

BRUEL & KJAER AUSTRALIA
www.bksv.com.au

C-MAC INDUSTRIES (AUST) PTY LTD
www.cmac.com.au

CSR BRADFORD INSULATION
www.bradfordinsulation.com.au

EMBELTON
www.vibrationisolation.com.au

FLETCHER INSULATION PTY LTD
www.insulation.com.au

KNAUF AMF AUSTRALIA PTY. LTD.
www.amfceilings.com.au

MASON MERCER AUSTRALIA
www.masonmercer.com.au

NSW ENVIRONMENT PROTECTION AUTHORITY
www.epa.nsw.gov.au

PYROTEK NOISE CONTROL
www.pyroteknc.com

REGUPOL (AUSTRALIA) PTY LTD
www.regupol.com.au

SOUNDBLOCK® SOLUTIONS
www.soundblock.com.au

THE P.A. PEOPLE PTY LTD
www.papeople.com.au

VIPAC ENGINEERS AND SCIENTISTS
www.vipac.com.au

Diary

2017

2 - 5 May, Rotterdam, Netherlands
Wind Turbine Noise 2017
www.windturbinenoise.eu

12 - 14 June, Kazimierz Dolny, Poland
The 13th International Conference on Active Noise and Vibration Control Methods (MARDiH-2017)
www.vibrationcontrol.pl

18 - 22 June, Zurich, Switzerland
12th ICBEN congress on Noise as a Public Health Problem
http://icben2017.org

25 - 29 June, Boston, USA
Acoustics 2017
Joint meeting of the Acoustical Society of America and the European Acoustics Association – Forum Acusticum
http://www.acousticalsociety.org

23 - 27 July, London, UK
24th International Congress on Sound and Vibration (ICSV24)
www.icsv24.org

27 - 30 August, Hong Kong
Inter-Noise 2017
http://www.internoise2017.org/

19 - 22 November, Perth
Acoustics 2017
AAS Annual Conference
www.acoustics2017.com

18 - 20 December, Honolulu, Hawaii
International Congress on Ultrasonics (ICU 2017)
http://www.icultrasonics.org/

2018

7 - 9 May, Ibiza Spain
NOVEM (Noise and Vibration Emerging Methods) 2018
novem2018.sciencesconf.org

27 - 31 May, Heraklion, Crete, Greece
EURONOISE 2018
https://euracoustics.org/

26 - 29 August, Chicago, USA
INTER-NOISE 2018
www.i-ince.org

11 - 15 November, New Delhi, India
WESPAC 2018
contact: vrsingh@ieee.org

2019

8 - 13 September, Aachen, Germany
23rd International Congress on Acoustics (ICA 2019)
www.ica2019.org

9 - 12 June, Madrid, Spain
48th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2019)
www.i-ince.org

Meeting dates can change so please ensure you check the conference website: http://www.icacommission.org/calendar.html