E-NEWSLETTER

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THE SOCIETY OF ACOUSTICS SINGAPORE

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I CONFERENCE NEWS

The 24th International Congress on Sound and Vibration(ICSV24) will be held in London, UK from 23 to 27 July 2017.

Woon Siong Gan will be organising three structured sessions on:

1. **Nonlinear acoustics and vibration**
2. **Acoustical metamaterials:theory and applications**
3. **Sound propagation in curvilinear spacetime**

Please visit www.icsv24.org for more informations.

2. CONFERENCE NEWS

The Society of Acoustics(Singapore) and the Indonesian Association of Vibration and Acoustics will be jointly organising the Regional Conference on Acoustics and Vibration from 26 to 29 Nov 2017 in Bali. Please visit the conference website: www.aavi.its.ac.id for more informations. The abstracts deadline is 20 June 2017. The registration fee is rather low only USD450.

II. ANNONCEMENTS

The Society of Acoustics will be sending out invoices to members with outstanding membership subscriptions. Members are encouraged to make payment in support of the Society.

The E-Newsletters will be made available to industrial contacts in an effort to promote the activities of the Society.

The Society is also exploring the possibility of organising talks and other professional events in collaboration with acoustic societies of other countries.

Membership Certificates will soon be made available to all members who had made full payments of membership dues

The Society aims to increase membership by inviting all persons, including those from the institution of higher learning and other related societies such as the Institute of Architects, Singapore and the members of the mechanical engineering division of the Institution of Engineers, Singapore who are qualified in the various field of Acoustics to join our Society.

We are especially keen to invite students to join our society and we are establishing the Youth Chapter soon.

III. MEMBERSHIP SUBSCRIPTION

Fellow	S$70
Member	S$50
Associate	S$30
Student	S$15
Corporate	S$200

FEE BASED ON ANNUAL RATE

FOR MORE INFORMATION PLEASE CONTACT: Dr.Gan at email: wsgan5@gmail.com

Membership application forms can be downloaded from the society website: www.acousticssingapore.com. Please complete and email to wsgan5@gmail.com

IV.ARTICLES

Electrically tunable membrane-type acoustic absorber

Zhenbo LU, Xiang YU, Yongdong CUI, Marco DEBIASI, Fangsen CUI, Li CHENG, Boo Cheong KHOO

Dielectric elastomer (DE) actuator is one of the up-to-date actuators, when an external voltage is applied between the electrodes, the elastomer membrane reduces its tension (by applying the Maxwell stress), thus enables the thickness reduction, area expansion, and the resonant frequency shift, converting electrical energy into mechanical energy. Its prominent features include: light weight, high energy density, high strain (>200%), fast response (<1 ms) and high efficiency (80%–90%) [1], which are much better than those of conventional smart actuators. Thus it has a lot of potential applications, such as medical devices, energy harvesters and space robotics [2]. Nowadays, most of researchers focus on the quasi-static deformation of DE actuator with respect to applications such as artificial muscles [3] or tactile displays [4]. However, as DE actuator can deform over a wide range of frequencies, it might have potential applications in acoustics and noise reduction technology, such as loudspeakers [5] or tunable resonators [6-7].

Inspired by the remarkable dynamic performances of DE actuator, a tunable dielectric elastomer acoustic absorber (DEAA) [8] and the corresponding tunable duct silencer [9-10] were originally proposed and investigated in T-Lab/NUS since 2013. They are made up with a DE pre-stretch membrane and a back cavity, it has found that not only the first resonance is shifted to a lower frequency, but also all the other resonances are shifted to lower frequencies by applying various external voltages on them. This implies that they can be potentially used for noise reduction technology as tunable Helmholtz resonators without any addition mechanical part.

Thereafter this innovative research work was further extended to vibroacoustic model of DEAA [11] and tunable acoustic resonator arrays [12] for enhancing its theoretical basis and attempting new concepts. A three-dimensional, analytical model based on the sub-structuring approach is developed to characterize the complex structure-acoustic coupling among the DE membrane and its surrounding acoustic media, it shows that such resonator provides sound attenuation in the medium frequency range by means of sound reflection as a result of membrane vibration, and the prediction accuracy of the proposed model is validated against experimental test. Furthermore, the transmission loss stop-band can be greatly enlarged by combining an array of DE resonators which can combine the multiple attenuation bands provided by each resonator unit.

In the future, take advantage of the electrically tunable membrane-type acoustic absorber, more research work can be focus on the tunable acoustic metamaterials with center masses or periodical structures for seeking the “next generation” broadband tunable absorbing materials which can have huge potential applications in building acoustics, aeronautics, astronautic and automotive industries.

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New Sound Insulation Material using Sonic Crystal

Woon Siong Gan

There has been an increase in awareness of the public in Singapore to annoyance caused by noise especially to construction noise,traffic noise and community noise. In fact internationally noise pollution has overtaken air pollution to be the second most important form of environmental pollution after water pollution. Traditionally, sound insulation material is in the form of fibre or woollen based material like rockwool. This has the weakness that thick, bulky material is needed for reducing low frequencie noise effectively. This is rather cumbersome and also not cost effective. Since the 1970s there is the rise of active noise cancellation technique which is electronic based using an opposite phase noise to cancel the existing noise. This has been successfully applied to earmuffs, airconditioning noise and recently even to three dimension space. The arrival of acoustic metamaterial developed and fabricated based on the symmetry properties of acoustic fields[1] and sonic crystal showed a resurge of interest in material based sound insulation technique. Acoustic metamaterial and sonic crystal have broad scope of applications to superlens based on negative refraction, acoustical cloaking, underwater acoustical cloaking, complex wave propagation phenomena, acoustic diode,acoustic metasurface, sound insulation materials etc. In this article, only the application to sound insulation using sonic crystal will be discussed.

The research described here was performed by a team led by Prof H P Lee of the department of mechanical engineering, National University of Singapore. The physics of sound propagaton in sonic crystal began in the early 1990s. In 1995 a group of Spanish researchers showed that sculpture altered the sound passing through it. Measurements showed that periodic tubular structure can trap sound waves of certain wavelength. This is a form of sonic crystal. The NUS team has reduced the size of this tubular structure to a much smaller scale able to implement on windows.Originally the sonic crystals have been used as noise barriers for years.

The scientific principle of the sonic crystal is based on the Helmholtz resonator. Each tube is hollow, with slit openings along its length. This is equivalent to a Helmholtz resonator which traps and dissipates lower noise frequencies. This enables the filtering of unwanted frequencies as the size of the resonator can be customised to absorb noise of a specific frequency from a particular machine. Noise hitting the window can be further suppressed by giving the louvres a sawtoothed edge to encourage destructive interference where sound cancels each other out.

Also parallel tubes separated by a given distance will be able to intercept sound which has wavelength of twice that distance. For traffic noise which has wavelength around 34 cm, it means having tubes whose central axes are about 17cm apart. Also the larger the tube diameter, the wider the range of wavelengths the array of tubes as a whole is able to block.

Sofar the prototype sonic crystal window is able to halve the loudness of traffic and construction noise entering a room through the window. It can reduce traffic and construction noised by almost 10 decribe which translates to halving of loudness. This is 5 dB or about 30 per cent better than a normal window glass louvres. Similar noise reducing sructures are found on the wings of owls, renowned for silent flight and on the engine covers of the Boeing Dreamliner.

Reference

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V.REPORT ON CONFERENCES

Western Pacific Acoustics Conference(WESPAC)- Dec 6 to 10 2015, Grand Copthorne Waterfront Hotel, Singapore

Singapore has the second highest number of 35 participants after the first place Japan with 95 registrations and the third was China with 32 participants.

The breakdown in field categories was as follows

1. **Architectural acoustics 132**
2. **Noise 119**
3. **Underwater acoustics 99**
4. **Signal processing in acoustics 80**
5. **Acoustical imaging 51**
6. **Railway acoustics 37**
7. **Engineering in acoustics 35**
8. **Structural vibration & acoustics 31**
9. **Acoustical metamaterials 26**
10. **Psychological acoustics 24**
11. **Musical acoustics 19**
12. **Ultrasonics 18**
13. **Speech communication 18**
14. **Physical & biomedical acoustics 11**

VI. BID FOR FUTURE INTERNATIONAL CONFERENCES

Riding on the success of Wespac 2015, the society is bidding to host the International Congress on Acoustics(ICA) in Singapore in 2025 and to host the International Congress on Sound and Vibration(ICSV) in Singapore in 2021

Government Bodies

www.mom.gov.sg

www.nea.gov.sg

www.lta.gov.sg

Technical and Research Sites

Corporate Sites

www.metaultrasound.com

www.noisecontrols.com

(The Society welcomes interested parties to contribute relevant websites to the above e useful links. For more information, please contact us. Thank you.)

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