

E-NEWSLETTER

March 2019 issue

THE SOCIETY OF ACOUSTICS SINGAPORE

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Year of Registration: 1989

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I.CONFERENCE NEWS

The 26th International Congress on Sound and Vibration(ICSV26) will be held in Montreal, Canada from 7 to 11 July 2019.

Woon Siong Gan will be organising three structured sessions on:

- 1. Nonlinear acoustics and vibration**
- 2. Acoustic metamaterials & phononic crystals: fundamentals and applications**
- 3. Sound propagation in curvilinear spacetime**

Please visit www.icsv26.org for more informations.

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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.

Please note that Acoustical Laboratory Pte Ltd has moved to the following new address:

**WE HAVE MOVED
TO OUR NEW OFFICE AT**

**318 Tanglin Road, #01-56, Phoenix Park Campus,
Singapore 247979.**

**OUR CONTACT NUMBERS REMAIN UNCHANGED.
Tel: (65) 6465 6212 Fax: (65) 6465 6223
Email: enquiry@aclab.sg Website: www.aclab.sg**

III.INTERNATIONAL ACOUSTICS NEWS

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Society of Acoustics, Singapore, Newsletter June 014

Woon Siong Gan was recently elected as a Director of the International Institute of Acoustics and Vibration(IIAV) for the period 2018 to 2022.

IV.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. Woon Siong 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

V.ARTICLE

Transport Theory and Metamaterials

Woon Siong Gan

Metamaterial is classified as a branch of condensed matter physics and is a form of new material. Since transport theory is now a key foundation of the theoretical design of new materials, it should be relevant to the design of new metamaterials. In one of my previous articles[1], I have pointed out the discovery of singularity behaviour of transport properties at the point of phase transition. It has been shown that at the point of transition from positive

phase material to negative phase material, indeed there is a singularity behaviour in the transport properties permeability for the electromagnetic case and bulk modulus for the acoustic case. In the plots of the permeability and bulk modulus versus frequencies, at the point of the resonance frequency or point of phase transition, there is a sudden increase of these parameters to infinity followed by a sudden drop to negative infinity and then a gradual

increase in value in the negative region.

Hence the application of transport theory which is the theory of transport properties is useful for the design of new metamaterials. In the acoustic case, so far only classical acoustic metamaterials have been developed and fabricated. It would be of great interest to extend this to quantum acoustic metamaterials within the understanding that there is also gauge invariance in quantum mechanics and that the Schrodinger equation obeys gauge invariance. Hence gauge transformation or coordinates transformation is also applicable to the quantum case for negative refraction and acoustic cloaking. It will be now time to investigate new metamaterials using the property of the singularity behaviour of transport properties at the point of phase transition. For instance, one can design the geometric structure of the unit cells to produce singularity behaviour of the transport properties such as permeability, permittivity, and bulk modulus at the resonance frequency of the geometric structure. The resonance frequencies are in terms of the transport properties.

It is also worth notice that in a quantum acoustic metamaterial, there is interactions between the unit cells and hence the unit cells will have nonlinear properties. The advantage of a quantum unit cell is that there will be no ohmic loss unlike the classical unit cells and also the quantum resonance will occur over a broadband different from the classical case of the resonance frequency which is limited only to a narrow band.

Another important characteristics of nonlinear unit cell is that there will a higher sensitivity. This can be illustrated by the simple case of for a linear term such as x with an error of 10% will become an error of 1% in the quadratic term of x^2 . The sensitivity of error detection has increased by 10 times in the

nonlinear quadratic case. This increase in sensitivity is an advantage of applying quantum acoustic metamaterials to the quantum negative refraction and quantum acoustic cloaking. To fabricate the quantum acoustic metamaterial, one has to shrink the size of the split ring resonators used as the unit cells to microscopic size in order to have the quantum effects.

Reference

1. Woon Siong Gan, Metamaterial is Artificial Phase Transition, e-Newsletter of the Society of Acoustics(Singapore), Sep 2017 issue.

VI. ACOUSTICAL NEWS

The National Environmental Agency of Singapore has launched a SGD 2 million new foundation to further encourage construction companies to use machineries with lower noise levels to provide a more quiet and pleasant living environment.

This new fund entitled Quieter Construction Innovation Fund will be for a period of two years and will replace the current Quieter Construction Fund which will expire on 31 March 2019. This new fund will assist construction companies to purchase, rent machineries or to use new methods to reduce the noise generated during construction and to enable the nearby residents to enjoy a more peaceful living environment.

The local construction companies can begin to apply for this fund from 1 April 2019 onwards. Each application is capped at three hundred thousand Singapore dollars. It will be different from the current framework. Those applying for reducing piling noise and demolition noise equipment and can have maximum eight thousand Singapore dollars assistance for application under two hundred Singapore dollars. For application exceeding half a million Singapore dollars will have a maximum three hundred thousand dollars subsidies. The condition is that these noise reducing equipment must be able to produce a 10 decibels noise reduction.

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To rent piling and demolition noise reduction equipment and materials can be entitled to a nine thousand to fifty thousand Singapore dollars assistance.

Up to end of February 2019, the current Quieter Construction Fund has approved 126 applications and provided a total of 5.1 millions dollars to 112 construction sites. It is anticipated that by the expiry of this fund, the total fund allocated will reach a level of 7.5 million dollars.

VI.REPORT ON CONFERENCES

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Society of Acoustics, Singapore, Newsletter June 014

The Regional Conference on Acoustics and Vibration (RECAV) organised by the Society of Acoustics(Singapore) and the Association of Acoustics and Vibration Indonesia(AAVI) was successfully held in Bali,Indonesia from 27 to 28 Nov 2017. There were 110 presentations from 14 countries with 60% of them from Indonesia. There were also some 18 exhibition booths. This reflected strong local participation and the international nature of the conference.

VII. BID FOR FUTURE INTERNATIONAL CONFERENCES

The Society of Acoustics(Singapore) will be hosting the ICSV28 in Singapore from 25-29 July 2021 at the Marina Bay Sands Hotel.

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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President: Woon Siong Gan
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