



**SOCIETY OF ACOUSTICS
(SINGAPORE)**

E-Newsletter December 2019 issue

Official Address : 33 Oxford Road, #04-03, Kentish
Court, Singapore 218816, Singapore
Tel : 67913242 and Mobile No. 90932730 Fax: 62990485
E-mail : wsgan@metaultrasound.com
Website : www.acousticssingapore.com

Registration No : 0331/1989
Year of Registration : 1989
President : Dr Gan Woon Siong
Secretary : Prof Y F Zhou
Treasurer : Prof Chen Jer Ming



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I. CONFERENCE NEWS

The 26th International Congress on Sound and Vibration(ICSV27) will be held in Prague, Czech Republic from 11 to 15 July 2020.

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.icsv27.org for more informations.



II. ANNOUNCEMENTS

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.



II. ANNOUNCEMENTS

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. MEMBER'S NEW ADDRESS

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



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

Towards Breaking the Turbulence Code-----Phase Transition and Molecules Interaction

Woon Siong Gan

The following is a brief version of the paper to be presented by me at the 27th International Congress on Sound and Vibration(ICSV27) in Prague, 12-16 July 2020.

Sofar turbulence is still an unsolved problem in physics. Important progresses have been contributed by Kolmogorov[1] in 1941 with the concepts of scale invariance , energy cascades based on statistical theories and that of Ken Wilson[2] with his interpretation of turbulence as a critical phenomenon and the use of the renormalization group method to solve the problem of the divergence of the correlation length at the critical point of phase transition.

V. ARTICLE

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V. ARTICLE

Sofar it has been well accepted that turbulence is a phase transition, as that proposed by de Gennes[3] in 1974. In 2009 Woon Siong Gan [4] put forward that turbulence is a second order phase transition with spontaneous symmetry breaking. This is an application of statistical mechanics. This means that turbulence is analogous to magnetisation with square lattice of ion sites and spins interaction. This is a mean field theory and can only explain the critical point of phase transition and unable to describe and analyse the region surrounding the critical point. During the last few years there is a general consensus that turbulence is a non-equilibrium phase transition represented by a model of interacting particles on a crystalline lattice directed percolation to be explained by statistical mechanics.

V. ARTICLE

There is growing trend of using statistical mechanics to treat turbulence along the same line as using statistical mechanics to treat magnetisation.

In this article I will carry a step further to describe the region surrounding the critical point. This is by the use of the 2D Ising model. I call this the Ising model for turbulence..The 2D Ising model is a rigorous theory of phenomenology unlike the mean field theory (MFT) which is phenomenology. The solution of the 2D Ising model of Lars Onsager[5] can only describe the critical point rigorously and also assuming that the magnetic field is zero.

V. ARTICLE

Lee and Yang [6] extended this to the presence of a magnetic field and also investigating the way in which the partition function becomes singular as T approaches T_c . They introduced the zeros of the partition function which is a polynomial that make the partition function becomes zero giving rise to the divergence of the free energy. These zeros are known as Lee Yang zeros and the distribution of the Lee Yang zeros produces the various phase transition points. Hence the computation of the Lee Yang zeros will give a picture of the region surrounding the critical point of phase transition.

V. ARTICLE

In this article, I will introduce the Ising model for turbulence will will give a rigorous theory instead of the MFT for turbulence. Then the zeros for the partition function for turbulence which I coined as G zeros will be derived. The following equations will support the concept above:

For 2D Ising model, for a given square lattice G_N , the partition function can be written as :

$$Z_{flat} = \sum_{m=0}^N \sum_{n=0}^{N_l} C_{mn} y^m c^n \quad (1)$$

V. ARTICLE

where N_l = number of links, N = number of faces in G_N when we put the spins on the faces, $c = e^{-2\beta}$, $y = e^{-2H}$, $y = \text{fugacity} = e^{\mu/kT}$, μ = chemical potential, k = Boltzmann constant, For a finite system, the zeros are never on the positive real axis since C_{mn} is positive and $c > 0$ for real β in eqn(1).

The Lee Yang zeros are computed from the following equation:

$$\frac{Z(\beta, H)}{Z(\beta)} = \langle \cos \text{Im}(H)M \rangle - i \langle \sin \text{Im}(H)M \rangle \quad (2)$$

For real $\beta = 1/kT$ and imaginary H = magnetic field.

V. ARTICLE

The j th Lee Yang zero will scale as :

$$H_j \sim N^{-\beta\delta/\nu d_H} \quad (3)$$

where δ = critical component, d_H = Hausdoff dimension, and ν = spin=spin correlation length exponent.

The first and second Lee Yang zeros can be computed as:

$$\frac{\beta\delta}{\nu d_H} = 0.773 \pm 0.013 \quad (j=1)$$

$$\frac{\beta\delta}{\nu d_H} = 0.788 + 0.033 (j=2).$$

V. ARTICLE

The above equations for magnetisation can be used for turbulence by using analogy by replacing the magnetic field H by the pressure field for the case of turbulence and the order parameter magnetisation by the RMS fluctuation quantity = $\sqrt{\overline{u^2}}$ where u = flow velocity.

This article only deals with the algorithm for obtaining the G zeros for complex turbulence field. The numerical computation of the G zeros and the experimental verification will be the subject matter of future papers.

References

1. Kolgomorov,A.N. The local structure of turbulence in incompressible viscous fluid for very large Reynolds numbers, [*Proceedings of the USSR Academy of Sciences*](#) (in Russian). **30**: 299–303(1941)..
2. Wilson, K. The renormalization group and the ϵ expansion *Physics Reports*. **12**(2): 75–199.(1974).
3. de Gennes,P.G. Phase transition and turbulence: an introduction,pp.1-18, *Fluctuations, Instabilities and Phase Transition*, T.Riste ed., Plenum Press, New York, 1975.
4. Gan,W.S. Turbulence is a second order phase transition with spontaneous symmetry breaking, *Proceedings of the ICSV16*, Krakow,Poland,2009.
5. Onsager,L. *Phys. Rev.* 65, 117 (1944).
6. Lee,T.D. and Yang, C.N. Theory of equations of state and phase transitions,II.lattice gas and Ising model, *Phy.Rev* 87,410,(1952).



VI. ACOUSTICAL NEWS

The International Commission for Acoustics(ICA)has announced that 2020 to be the International Year of Sound (IYS 2020) and recommending activities around the world for this event. I strongly advise our society members to recommend what sort of activities they would like for the IYS 2020. They can email them to me to: wsgan5@gmail.com

VI. ACOUSTICAL NEWS

Importance of Sound for Society and the World

www.sound2020.org



The board of the ICA is delighted to announce that the International Year of Sound 2020 will be formally opened on Friday 31 January 2020 at the Grand Amphitheatre Sorbonne University, Paris.

Overview plan



Overview plan

The ICA and La Semaine du Son (LSdS) have signed a Memorandum of Understanding and will cooperate to achieve international recognition of the goals of UNESCO Resolution 39 C/49 25 September 2017 on “The Importance of Sound in Today’s World: Promoting Best Practices” in the framework of the International Year of Sound 2020 (IYS 2020).

The IYS 2020 will comprise activities organised centrally by ICA, activities organized by La Semaine du Son and activities organized by the ICA Member Societies and International Affiliates. In this respect, the ICA is mobilizing its Member Societies and International Affiliates to arrange activities during 2020 that will promote best practices in sound.



ICA Central Activities

- These will include at least:
- Official Opening on 31 January 2020.
- Production of a Video highlighting the importance of sound in all aspects of life. The video will be
- An International student competition on the importance of sound.
- Organization of Special thematic sessions in major International Conferences to be held in 2020.
- Hosting of the website www.sound2020.org
- Promoting member activities
- Creating a record of the activities These activities will be financially covered by the ICA budget and by sponsorship.



ICA Member Activities

ICA Member organisations are encouraged to host activities that highlight the importance of sound in our world and will promote best practices in sound. These activities may include National Conferences on Acoustics, thematic conferences and workshops related to sound, seminars, concerts and special events addressed to the public, and involvement of the media. The details of the outreach activity will be posted on the IYS 2020 website. The logo for IYS 2020 can then be used in the promotion and a short report will be provided as a record of that event.

These activities will be financially covered by the Member's budget



La Semaine du Son Activities

LSdS hosts weeks of sound throughout France as well as Belgium, Argentina and is expanding to other countries such as Lebanon and Japan. During 2020 these will be recorded as contributions to meet the goals of the IYS 2020 as well as the UNESCO

Resolution 39 C/49. More information on LSdS from
www.sound2020.org



Founding Supporters

We are particularly grateful to our Founding Supporters (ASA, I-INCE, IIAV, EAA) who provided some seed funding which combined with ICA funding provided the necessary support to reach this stage.



Sponsorship

To reach our goal for the centrally funded activities sponsorship is required. Sponsors will receive extensive coverage from the website and from the centrally organised and nationally organised activities.

Sponsorship prospectus is available from www.sound2020.org



Sponsorship

ICA EVENTS at a glance

HOST WEBSITE www.sound2020.org

OPENING 31JANUARY IN PARIS

VIDEO ON IMPORTANCE OF SOUND

INTERNATIONAL STUDENT COMPETITION

PROMOTE NATIONAL EVENTS

PROVIDE REPORT ON ALL ACTIVITIES

ICA MEMBER ORGANISATIONS

PLAN YOUR IYS 2020 EVENT

OUTREACH TO HIGHLIGHT

IMPORTANCE OF SOUND AND
PROMOTE BEST PRACTICES

POST THE DETAILS OF EVENT ON www.sound2020.org

RECEIVE THE IYS2020 LOGO

PLUS GOLD SPONSOR LOGO

HOLD THE EVENT
PROVIDE SHORT REPORT



Importance of Sound
for Society and World

Initiated by :



In cooperation with



www.sound2020.fr
Founding members






The road map to the IYS 2020

It has taken considerable time to get this stage. In 2011 the ICA Board agreed to the concept of an International Year of Sound to be declared before the end of the decade. This was endorsed at the General Assembly in 2013. We spent some time following the same path as for the International Year of Light by seeking UNESCO and ultimately the UN approval. For various reasons that pathway became unachievable so in 2018 we established an agreement with the organisers of La Semaine du Son (LSdS) to work collaboratively to arrange an International Year of Sound in 2020. LSdS had been the primary force behind the UNESCO Resolution 39 C/49 25 September 2017 on “The Importance of Sound in Today’s World: Promoting Best Practices”. In 2019 a Memorandum of Agreement was signed between the ICA and LSdS. The IYS2020 becomes one of the outcomes of that resolution.

IYS 2020 Structure

Liaison Committee: overview and coordination of the IYS 2020. ICAMichael Taroudakis and Marion Burgess

LSdS Christian Hugonnet, Jean-Dominique Polack and Nicolas Lounis

Steering Committee:

Encourage and coordination of central and regional activities Coordinators:

Marion Burgess and Michael Taroudakis Regional responsibility:



Be seen Internationally

BECOME AN IYS2020 SPONSOR

GOLD SPONSORS

LOGO on all IYS2020 publicity

Other levels of Sponsorship available

PROSPECTUS FROM www.sound2020.org

Europe/Africa:

Michael Vorländer, Antonino di Bella, Antonio Perez-Lopez
Asia/Pacific:

Jeong-Guon Ih, Kohei Yamamoto
Americas:

Mike Stinson, Fausto Rodrigues, Julio Cordioli



SOCIETY OF ACOUSTICS (SINGAPORE)

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National Coordinators:

Representatives from all ICA Member Societies and International Affiliates will be responsible for the coordination and the reporting of the national activities and the activities of the International Affiliates. The Member Societies and International Affiliates are requested to appoint their representative by the end of September 2019. Name to be sent to the ICA Secretary General,

(ICASecGen@icacommission.org).



Also our society is in the process of setting up the regional Singapore Chapter of the Acoustical Society of America(ASA).



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.)



VII. BID FOR FUTURE INTERNATIONAL CONFERENCES

Disclaimers

The information and articles provided in this E-Newsletter are meant for the information for all readers. No warranties are given and none may be implied directly or indirectly relating to the use of the information by any person or organisation. Under no circumstances shall the authors, contributors or the Society of Acoustic, be liable for any collateral, special or consequential damage as a result of the use of the information contained in the article.

President : Woon Siong Gan

E-Newsletter compiled by : Woon Siong Gan