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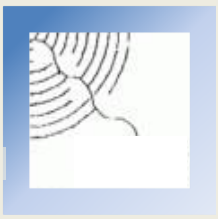

E-NEWSLETTER

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December 2022 issue

THE SOCIETY OF ACOUSTICS SINGAPORE

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CONTENTS

ACOUSTICS NEWS

I.CONFERENCE NEWS

. i. The 29^{7h} International Congress on Sound and Vibration(ICSV29) will be held in Prague,Czeh Republic from 9 to 13 July 2023 and will be a physical conference.

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.icsv29.org for more informations.

ii. **The First ASEAN International Acoustics Conference**. will be held online on the 9 May 2023,Tuesday. The theme of the conference will be International Noise Awareness. It will be organised by the ASEAN Acoustics Commission. The deadline for 300 words abstracts submission will be 15 March 2023. The conference will be free to all members of the acoustical societies and associations under the ASEAN Acoustics Commission. For non-members, the registration fee will be SGD 20. Please send all abstracts to: wsgan5@gmail.com and for further informations please email wsgan5@gmail.com.

II.ANNONCEMENTS

The Society of Acoustics(Singapore) 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 zoom seminars/workshops and other professional events in collaboration with acoustic societies of the ASEAN 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.INTERNATIONAL ACOUSTICS NEWS

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.ARTICLES

The following article is a condensed form of the paper to be presented at the ICSV29 in Prague,9-13 July 2023.

Towards breaking the Turbulence code:II.Transport Theory Explanation of Turbulence.

Woon Siong Gan

ABSTRACT

Transport theory is the theory of transport phenomenon. Phase transition is a transport phenomenon. Turbulence is a form of phase transition. Transport phenomenon consists of two characteristics: singularity behaviour and particles interaction. Turbulence possesses the singularity behaviour of its transport property,at the critical point of phase transition. That is viscosity tends to be zero with the infinite Reynolds number. There is also the water molecules interaction aspect of turbulence. This is analogous to the spins interaction in magnetization which is described by the Ising model. In turbulence, the molecules interaction is described by the G model. Turbulence possesses both the singularity behaviour during phase transition and the particles interaction aspect of the transport phenomenon. The action principle and the path integral method are used to treat the water molecules interaction. The G model gives rise to the G zeros of the complex partition function for turbulence. The G zeros for turbulence can be used to study the region surrounding the critical point for turbulence.

Section One Introduction

Turbulence is a form of phase transition,from the laminar flow phase to the turbulence flow phase. It can be interpreted as a second order phase transition with spontaneous symmetry breaking at the critical point of zero viscosity[1]. This a meanfield theory and is not able to explain the region surrounding the critical point of phase transition. The Lee Yang theory [2] is developed with the G zeros ,an analogy of Lee Yang zeros to describe the gradual transition to the critical point in the region surrounding the critical

point. Recently, there was the discovery of the singularity behaviour of the transport properties at the critical point of phase transition{3]. This shows that phase transition has the same characteristics as transport phenomena. These are the singularity behaviour and the role played by the interaction among the microscopic particles. Since turbulence is considered as a phase transition,it should possess these two characteristics of the transport phynomenon. These are the singularity behaviour of the viscosity towards at the critical point of phase transition and the water molecules interaction. These two characteristics will be described in more details in the next sections.

Section Two Molecules Interaction

Water molecules interaction can be treated using quantum mechanics with the use of many-body theory. Analytical potential energy functions are used to represent the many body effects. Starting from the many body expressions of the interaction energy.

The realistic computer simulation of water should include an accurate representation of the underlying Born-Oppenheimer potential energy surfaces in combination with a proper treatment of the nuclear motion.

This is the development of analytical potential energy functions that aim at correctly epresenting many-body effects. Starting from the many-body expansion of the interaction energy,specific focus is on different classes of potential energy functions build upon a hirerarchy of approximation and on

their ability to accurately reproduce reference data obtained from state-of-the-art electronic structure calculation and experiental measurements. The potential energy function which includes explicit short-range representation of two-body and three-body effects along with a physically correct description of many-body effects at all distances, predict the properties of water from the gas to the condensed phase with unprecedented accuracy.

The global potential energy surface(PES) of a system containing N interacting water molecules can be formally expressedin terms of the many body expansion of the interaction energy as a sum over n body terms with $1 \leq n \leq N$.

$$V_N\ (r_1,\ldots\ldots,r_N) = \sum_{i=1}^{N} V_{1B}(r_i) + \sum_{i<j}^{N} V_{2B}(r_i,r_j)\ +\ \sum_{i<j<k}^{N} V_{3B}\ (r_i,r_j,r_k)$$

$$+\ \ V_{NB}(r_1,r_2,r_{3,\ldots\ldots\ldots\ldots r_N}) \qquad\qquad (1)$$

where $r_i$collectively denotes the coordinates of all atoms of the ith water molecule.In eqn(1), V_{1B} is the one-body(1B) potential that describes the energy required to deform an individual molecule from its equilibrium geometry.

The PEF(potential energy function)s developed for computation simulations of water can be conveniently classified according to the level of approximation used to represent the different term can be conveniently

classified according to the level of approximation used to represent the different terms of eqn(1). Starting with the 1B term, most common and least realistic force fields assume rigid geometries for the water molecules, with intramolecular flexibility being explicitly taken into account only in more sophisticated energy expressions. The different treatment of the V_{1B} term thus leads to a separation of the existing PEFs in two main groups, the "rigid-monomer" and the "flexible-monomer" PEFs. Within each group, analytical PEF for water can be further distinguished based on how all V_{nB} terms of eqn (1) with n $>$ 1 are described.

Section Three Singularity Behaviour of Phase Transition

It is well known that phase transition has singularity behaviour[4] such as the singularity behaviour of the partition function at the critical point. This behaviour was studied by the Lee Yang theory[2]. Besides the singularity behaviour of the partition function, recently, it was discovered that the transport properties have singularity behaviour at the critical point[3]. This is an important aspect of phase transition. Examples are the zero viscosity of turbulence flow, infinite conductivity of superconductivity, zero viscosity of superfluidity,zero conductivity of insulator, and zero magnetization of ferromagnetism.

Turbulence possesses both the molecules interaction aspect and the singularity of transport properties of the transport phenomenon. Hence it can be considered as a transport phenomenon and can be fully explained by the transport theory.

References

1.Woon Siong Gan, Turbulence as second order phase transition, with Spontaneous symmetry breaking, Proceedings of ICSV

2. C. N. Yang and T. D. Lee, Statistical theory of equations of state and phase transitions. I. Theory of condensation, Phys. Rev. 87, 404 (1952). [2] T. D. Lee and C. N. Yang, Statistical theory of equations of state and phase transitions. II. Lattice gas and Ising model, Phys. Rev. 87, 410 (1952).

3.Woon Siong Gan, Transport theory approach to phase transition, Proceedings of ICSV28,July 2022,Singapore.

4.Edward Joseph Mayer and Goeppert Maria Mayer,Statistical Mechanics, John Wiley & Sons, 1940.

VI. PRODUCTS ON ACOUSTICS

VII. ACOUSTICAL NEWS

The following joint zoom seminar was held on August 30 2022 from 4 to 5pm Singapore time. There were some thirty participants.

Name of Speaker: James Bligh- Technical Director ,Pliteq AP of Canada.

Title of Talk: Design of floating floors using recycled

elastomers: Reducing embodied carbon**.**

CV of Speaker:

James Bligh is the Technical Director,specialising in engineered acoustic systems fro recycled materials. Having over a decade of experience in acoustics,his career has been equally split between Acoustic Consultancy and AcousticEngineering. Leveraging Pliteq's commitment to providing third party laboratory data to support Acoustic specifications and design,his focus is on reducing embodied carbon in acoustic design,whilst providing excellent Acoustic conditions in buildings and infrastructure.

Summary of talk: This talk will be on the recycling of materials to produce sound insulation material which will enable the reduction of material thickness and hence carbon emission.

VIII.REPORT ON CONFERENCES

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.

The 28th International Congress on Sound and Vibration(ICSV28) jointly organised by the International Institute on Acoustics & Vibration(IIAV) and the Society of Acoustics(Singapore) as a hybrid event with the physical section held at the Marina Bay Sands from 24 to 28 July 2022 . It was held successfully with over three hundred papers presentations.

IX. BID FOR FUTURE INTERNATIONAL CONFERENCES

The Society of Acoustics(Singapore) will be bidding for hosting the ICA 2031 in Singapore in 2031.

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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

E-Newsletter compiled by Woon Siong Gan