THE SOCIETY OF ACOUSTICS SINGAPORE

E - NEWSLETTER

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CONTENT

I. CONFERENCE NEWS

1. The ICSV28(28th International Congress in Sound and Vibration) was successfully held in Singapore as an hybrid event with 160 physical participants and 201 online attendants.

2. The First Online ASEAN International Acoustics Workshop. Was successfully held online on the 9 May 2023,Tuesday with 52 participants from eight nationalities of UK, Russia, Spain, India, Indonesia, Malaysia, Singapore, and Thailand.

3. The Singapore chapter of the IEEE Ocean Engineering Society organised a Distinguished Lecture by Prof John R Potter on Listening at the Speed of Light: what could Distributed Acoustic Sednsing do for you? on 21 September 2023 both online and physically at S2S Conference Room, Tropical Marine Science Institute, National University of Singapore. This lecture was also supported by the Society of Acoustics(Singapore).

4. The Society of Acoustics(Singapore) also jointly organized with the Association of Vibration and Acoustics of Thailand a webinar on the 6 October 2023. The title was Algorithm for calculation of the measured single fly-over aircraft noise and was given by Thapara Boonohoo and Krittika Lertsawat. It was highly successful with 26 participants.

II. ANNOUNCEMENTS

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

ACOUSTICS 23, SYDNEY will be held in the Convention Centre, Sydney from 4 to 8 December 2023. It will be a joint meeting of the Acoustical Society of Australia, Acoustical Society of America, Western Pacific Acoustics Conference(WESPAC) and the Pacific Rim Underwater Acoustics Conference.

Conference website: https://acoustics23sydney/org

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

IV. ARTICLES

The following article is a condensed form of the paper to be presented at the ICSV30, Amsterdam

Lee Yang Theory is a Subset of Transport Theory-Transport Theory is the Theory of Phase Transition

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Abstract

Transport theory has two parts: the singularity behaviour of the transport properties at the critical point of phase transition and particles interaction .Phase transition on the other hand also consists of two components: the singularity characteristics and particles interaction.The Lee Yang theory is for the description of phase transition but it only analyses the singularity characteristics of the partition function at the critical point of phase transition, Hence it can be considered as a subset of the transport theory. Since both transport theory and phase transisiton consist of the same two components: the singularity characteristics and particles interaction, transport theory can be considered as the theory of phase transition.

Key Words: transport theory,,Lee Yang theory,phase transition,particles ,interaction,singularity characteristics.

1. Introduction

C N Yang 's works on phase transition consist of two parts: the first part is the work with T D Lee known as the Lee Yang theory[1],focusing on the singularity characteristics of phase transition. That is on the singularity behavior of the partition function at the critical point of phase transition. The Lee Yang zeros are the roots of the various terms of the power series of the partition function. They are a distribution of zeroes at the region near the critical point, describing the gradual transition of the zeroes to become the eventual zero giving rise to the phase transition. The second part of C N Yang's works on phase transition is his collaboration with T D Lee and Kerson Huang [2] on the particles interaction

The following article is a condensed form of the paper to be presented at the ICSV30, during phase transition using Fermi's pseudopotential approach to the hard spheres interaction of the fluid particles during phaese transition. Transport theory on the other hand also consists of two parts:

first part is the singularity behaviour of the transport properties at the critical point of phase transition and the second part is particles interaction such as electron–phonon interaction, phonon–phonon interaction, electron–electron interaction . Hence the Lee Yang theory is analogous to the first part of the transport theory and hence can be considered as a subset of the transport theory.

2.Singularities Characteristics of Phase Transition

It has been well known that singularities is a characteristics of phase transition. There are several aspects

of the singularities characteristics of phase transition. One is Mayer's vision by the expansion of the fugacity expresssin[3]. Another is the Lee Yang zeros[1] of the partition function during phase transition and the third is the discovery by Woon Siong Gan [4]of the singularity behaviour of the transport properties at the critical point of phase transition.There is Mayer[3]'s vision of a singularity at condensation. At a first order transition, one must expect an essential singularity . The concept of an essential singularity at condensation was independently advanced by A.E.Andreev[5]. For a lattice gas, the result was proved with full mathematical rigour by S N Isakov[6]. C N Yang[2] has related how Mayer[3] in 1937 approached the problem of condensation of a fluid from a vapour to a liquid. Mayer[3] developed systematic cluster expansions that as Yang[2] observes started analysis of the mathematics and physics of such phenomenon. In fact, Mayer[3] xpected some sort of mathematical singularity at the condensation point.

The other aspect of singularity characteristics of phase transition has been analyzed by Lee and Yang[1] They went into the complex plane of fugacity z= partition function= $e^{(-2H/kT)} \infty e^{(\mu/kT)}$ where H= energy of state of particle, μ=chemical potential and k = Boltzmann's constant and grand canonical partition function = Ω described by:

$$(z,\Omega) = \prod_{(n=1)}^N [1 - z/(z_n (T))]$$

where $z_n(T)$ = Lee Yang zeros.

They discovered the Lee Yang zeros which are the roots of the various terms of the grand canonical partition function,a polynomial of degree N of a finite domain Ω that contains N particles. Since Ξ must be real and positive for positive real z and T,all zeros of the polynomial (z) must lie in the complex plane (or on the negative real axis). As a result, knowing the distribution of the zeros amounts to a full knowledge of the thermodynamics . Consequently ,if the zeros approach the real axis as N→∞, a singularity must must appear in the thermodynamic limit at the corresponding value of T. The Lee Yang zeros give a knowledge of the region surrounding the critical point of phase transition.

The third characteristics of phase transition is the singularity behaviour of the transport properties at the critical point of phase transition. This was discovered by Woon Siong Gan[4]. This characteristics can be a guidance for the discoveries of new phase of matter by searching for a material property which becomes zero at certain temperature, the critical temperature when phase transition takes place. The three prominent examples of singularity behaviour of transport properties are: specific heat singularity in liquid-gas transition[7],the zero viscosity of superfluidity and the zero electrical resistance in superconductivity. The specific heat of Argon and O_2near the critical temperature T_c has been measured at the critical volume. The measured specific heat displays sharp peaks at T_c,suggesting logarithmic infinity.

One of the strangest properties of superfluid helium is that it has zero viscosity. A flowing liquid experiences viscosity that causes it to slow down. Superfluid helium has zero viscosity and it spontaneously creates vortices that spin without resistance. Superfluidity is the characteristic property of a fluid with zero viscosity which therefor flows without any loss of kinetic energy. When stirred, a superfluid forms vortices that continue to rotate indefinitely. The theory of superfluidity was developed by Lev Landau and Isaal Khalatnikov[8].

Superconductivity is a set of physical properties observed in certain materials Where electrical resistance vanishes and magnetic fields are expelled from the material. Unlike an ordinary metallic conductor whose resistance decreases gradually as its temperature Is lowered, even down to near absolute zero, a superconductor has a characteristic critical temperature below which the resistance drops abruptly to zero[9].

An electric current through a loop of superconductivity wire can persist indefinely with no power source. Superconductivity is the property of certain materials to conduct direct current DC) electricity without energy loss when they are cooled below the critical temperature.

4.Particles Interaction

The second part of the transport theory deals with particles interaction such as electron-phonon Interaction, phonon-phonon interaction, electron-electron interaction etc. When applying transport theory to phase transition, this applies well to the particles interaction part of phase transition. Lee Yang theory[1] when applied to phase transition does not deal with the interaction part. It only deals with the singularity nature of phase transition. So in this aspect, it can be considered as a subset of the transport theory. C N Yang also deals with the particle interaction aspect of phase transition but not under Lee Yang theory[1] but separately with T D Lee and Kerson Huang[2] under hard spheres interaction which is an application of Fermi's pseudopotential approach. The pseudopotential approach to hard spheres interaction is one of the methods of solving many body problems. An example[2] is to use this approach to calculate the ground state energy E_0 of a Fermi surface successfully. They consider an N-particle quantum mechanical system enclosed in a volume V, in which the particles interact in a two-body hard-sphere potentials, with hard sphere diameter a.

The two-body hard-sphere problem is first discussed by a generalization of Fermi's pseudopotentials By means of which the problem is formulated entirely in terms of the scattering phase shift. It is then shown that a pseudopotential for the N-body problem can be introduced ,and leads to an expansion of the energy levels of the system in powers of a. The first order energy levels of a Bose and a Fermi system are calculated. For the Bose system, the first order energy formula exhibits an energy gap above the ground state, leading to properties of the system not dissimilar to that of a superfluid . The ground state energy for a Bose system is calculated to order a^3 and that for the Fermi system to order a^3.

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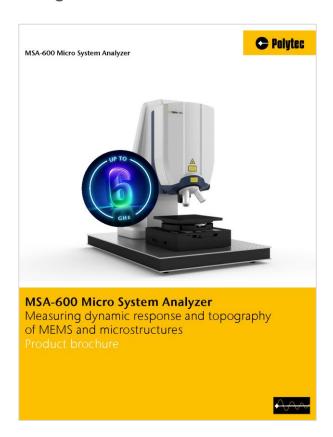1. C.N.Yang and T.D.Lee,Statistical theory of equations of state and phase transition,I.theory of condensation,Phys.Rev.,87,no.3,1952. T..Lee and C.N.Yang, Statistical theory of equations of state and phase transition,II.Latatice Gas and Ising model,Phys.Rev.,87,no.3,1952.

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VI. PRODUCTS ON ACOUSTICS

Please find below the information's on the latest long-distance laser vibrometer from Polytec provided by Chris Chia.

Long Distance Laser Vibrometer from Polytec

Please click the link below to find more details about the product
https://www.polytec.com/

VII. ACOUSTICAL NEWS

The ASEAN Acoustics Commission was founded in March 2023. It comprises of the national acoustical associations and societies from Indonesia, Malaysia, Singapore, and Thailand. This is for the purpose of regional cooperation in parallel with the WESPAC (Western Pacific Acoustics Commission). Members of the individual acoustical associations and societies of the comprising countries will automatically become individual members of the Acoustics Commission with no additional membership fees needed. The Acoustics Commission will organize regional acoustical conferences and publish an e-newsletter periodically..

VIII. REPORT ON CONFERENCES

The 28th International Congress on Sound and Vibration(ICSV28) jointly organized by the International Institute on Acoustics & Vibration(IIAV) and the Society of Acoustics(Singapore) was held successfully as a hybrid event with 160 physical participants and 201 online attendance. It was held at the Marina Bay Sands from 24 to 28 July 2022

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.geonoise.asia (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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