International Symposium on Numerical Methods in Heat and Mass Transfer 2020

2020 传热传质数值方法国际学术会议

Program & Abstracts
11-13 December, 2020

Sponsored by:

Ningbo Association of Science and Technology
宁波市科学技术协会

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Welcome

We hereby warmly and sincerely welcome you to join the International Symposium on Numerical Methods in Heat and Mass Transfer 2020 (ISNMHMT2020), which is jointly organized by Youth Committee on Heat and Mass Transfer of the Chinese Society of Engineering Thermo-physics, University of Nottingham Ningbo China (UNNC), Ningbo Key Laboratory on Energy Material and Technology as well as Ningbo Innovation Team of Frontier Technologies on Thermal Management in Low-carbon Vehicles.

As with precedent conference ISNMHMT2019 which was successfully held in Hangzhou in 2019, the focus of ISNMHMT2020 will be to continue to promote academic exchanges and strengthen the cooperation between domestic and international scholars in multiple fields, including engineering thermo-physics, heat and mass transfer and numerical computing. The main themes of ISNMHMT2020 will cover diverse areas including heat transfer in micro/nano scale, convective thermal fluids, radiation, multiple-phase flow, reactive processes, energy storage, heat transfer in water and hydro-dynamics, heat transfer in air and aerodynamics.

Conference Organization

Organized by

Youth Working Committee of Heat and Mass Transfer Branch of Chinese Society of Engineering Thermo-physics
University of Nottingham Ningbo China
Ningbo Key Laboratory of Energy Technology and Energy
Ningbo Innovation Team of Frontier Technologies on Thermal Management in Low-carbon Vehicles

Conference Chairs

Prof. Yuying Yan
University of Nottingham

Prof. Yuying Yan is Professor of Thermofluids Engineering at University of Nottingham. With more than 30 years experience in fluid flow and heat transfer, he is a member of EPSRC Peer Review College; Associate Editor of Elsevier Journal - Case Studies of Thermal Engineering, Editorial Board member for International Journal of Heat and Mass Transfer, Nature Publishing Group's multidisciplinary Journal: Scientific Reports, Journal of Bionic Engineering, and Elsevier Journal of Thermal Science and Engineering Progress. He is fellow of International Society of Bionic Engineering. He has supervised more than 30 PhD students and authored or co-authored more than 200 academic papers in refereed journals.

Prof. Bingyang Cao
Tsinghua University

Prof. Bingyang Cao is the vice dean of School of Aerospace and Aeronautics, Tsinghua University. He received the Distinguished Youth Award from the National Natural Science Foundation of China in 2018, the first prize of natural science from the Ministry of Education in 2019, and the IAAM Medal from the International Advanced Materials Society in 2019. He is currently the director of the Youth Committee on Heat and Mass Transfer of the Chinese Society of Engineering Thermophysics and the member of the Committee on Heat and Mass Transfer of the Chinese Society of Engineering Thermophysics. His main research fields are micro-nano energy system and advanced thermal management technology. He is the editor-in-chief of the International Journal titled “ES Energy & Environment”.

Executive Chairs

Yong Ren, University of Nottingham Ningbo China
Yuan Dong, Hangzhou Dianzi University

Academic Committee Members

Yong Shi, University of Nottingham Ningbo China
Mingjia Li, Xi 'an Jiaotong University
Kun Luo, Zhejiang University
Liwu Fan, Zhejiang University
Kai Chen, South China University of Technology

UNNC Conference Committee Members

Jane Wang, Kelly Fu, Chenxu Liu, Zhiyu Zhang, Tuo Hou, Maxine Yew, Xiangzhi Zhang, Chenyang Xue, Ying Li, Yujiao Xie, Xiawei Xu, Fei Long, Xinyue Zhao, Tingyu Lin, Yuchen Xiao, Hanyang Ye, Yutong Peng, Yao Tom

Conference at a Glance

Conference Venue

University of Nottingham Ningbo China
199 Taikang East Road, Ningbo, 315100, China

Onsite Registration

Registration hours:

Friday	December 11th	12:00-20:00

Lobby of Boya International Exchange Center (LA Hotel)

Saturday	December 12th	8:30-17:30

Lobby of New Auditorium and lobby of IAMET 121

Contact: Jane Wang 15857491242

Presentation Types

Plenary Lecture	35 minutes
Keynote Speech	25 minutes
Oral Presentation	15 minutes

Audiovisual Services

Each room will be equipped with only one projector with VGA connector. We strongly recommend that you check the compatibility of your computer with the provided projector well before the start of your session. Presenters are encouraged to use the computers provided in the conference session rooms.

Reception Dinner (For those who have completed registration process)

Riverside Banquet, 1st floor, Boya International Exchange Center (LA Hotel)
17:30-20:00 Friday, 11 Dec 2020

Lunch Buffet (For those who have completed registration process)

Riverside Banquet, 1st floor, Boya International Exchange Center (LA Hotel)
12:00-14:00 Saturday, 12 Dec 2020
Riverside Banquet, 1st floor, Boya International Exchange Center (LA Hotel)
12:00-14:00 Sunday, 13 Dec 2020

Conference Banquet (For those who have completed registration process)

Tianwei Hotel 18:00-20:30 Saturday, 12 Dec 2020
Two buses will be departing at 5:30 pm 12 Dec 2020 in front of IAMET Building to the hotel for dinner

The Zoom online meeting links for access to all conference events:

12 Dec 2020
Opening Ceremony & Plenary Lectures

Join Zoom Meeting
https://unnc.zoom.com.cn/j/62039333880?pwd=aUtBa0l0YWRuRHNEd01XelhWaVdOUT09
Meeting ID: 620 3933 3880
Password: 181881

Parallel-sessions
#1: Transport Phenomena of Droplet
Join Zoom Meeting
https://unnc.zoom.com.cn/j/69404663874?pwd=U3Z0Z1NId1lDczR6TVZtVmNiUHBuZz09
Meeting ID: 694 0466 3874
Password: 387994

#2: Advanced Thermal Management
Join Zoom Meeting
https://unnc.zoom.com.cn/j/62482626992?pwd=WlVFOGsvdkcwS25Cby9tYkFpVjVoUT09
Meeting ID: 624 8262 6992
Password: 915681

#3: Multiple Phase Flow and Renewable Energy
Join Zoom Meeting
https://unnc.zoom.com.cn/j/64304633516?pwd=VGZTZjhBa2Vva2ZOMTc5SHpKMFJkQT09
Meeting ID: 643 0463 3516
Password: 416220

#4: Transport of Electrons and Phonons & LBM
Join Zoom Meeting
https://unnc.zoom.com.cn/j/63071814408?pwd=b3M1OER6MjV6MjJkWHZGN05NVGF0QT09
Meeting ID: 630 7181 4408
Password: 093034

#5: Heat and Mass Transfer in Advanced Materials
Join Zoom Meeting
https://unnc.zoom.com.cn/j/61415712584?pwd=djlUelNUMGJXVW42Y0pQTU1LS0J3QT09
Meeting ID: 614 1571 2584
Password: 542340

#6: Thermal Fluid Dynamics
Join Zoom Meeting
https://unnc.zoom.com.cn/j/66561020903?pwd=OFNCOUhiU2RpNmlRcStBTFU1NUVFUT09
Meeting ID: 665 6102 0903
Password: 674008

13 Dec 2020

Plenary Lectures
Join Zoom Meeting
https://unnc.zoom.com.cn/j/65082092403?pwd=UjhsOCtZM2Q4bXVBTGJYanBVRlp0UT09
Meeting ID: 650 8209 2403
Password: 338588

Parallel-sessions
#7: Transport Phenomena of Droplet
Join Zoom Meeting
https://unnc.zoom.com.cn/j/64541715876?pwd=dTJpd1Z4WTZsTHZyNSs5dUpUZEltZz09
Meeting ID: 645 4171 5876
Password: 753099
Host Key: 506635

#8: Advanced Thermal Management
Join Zoom Meeting
https://unnc.zoom.com.cn/j/67537938941?pwd=UUx6cWZOa3dZc2FhVlFkeXQ2NEhoUT09
Meeting ID: 675 3793 8941
Password: 302597

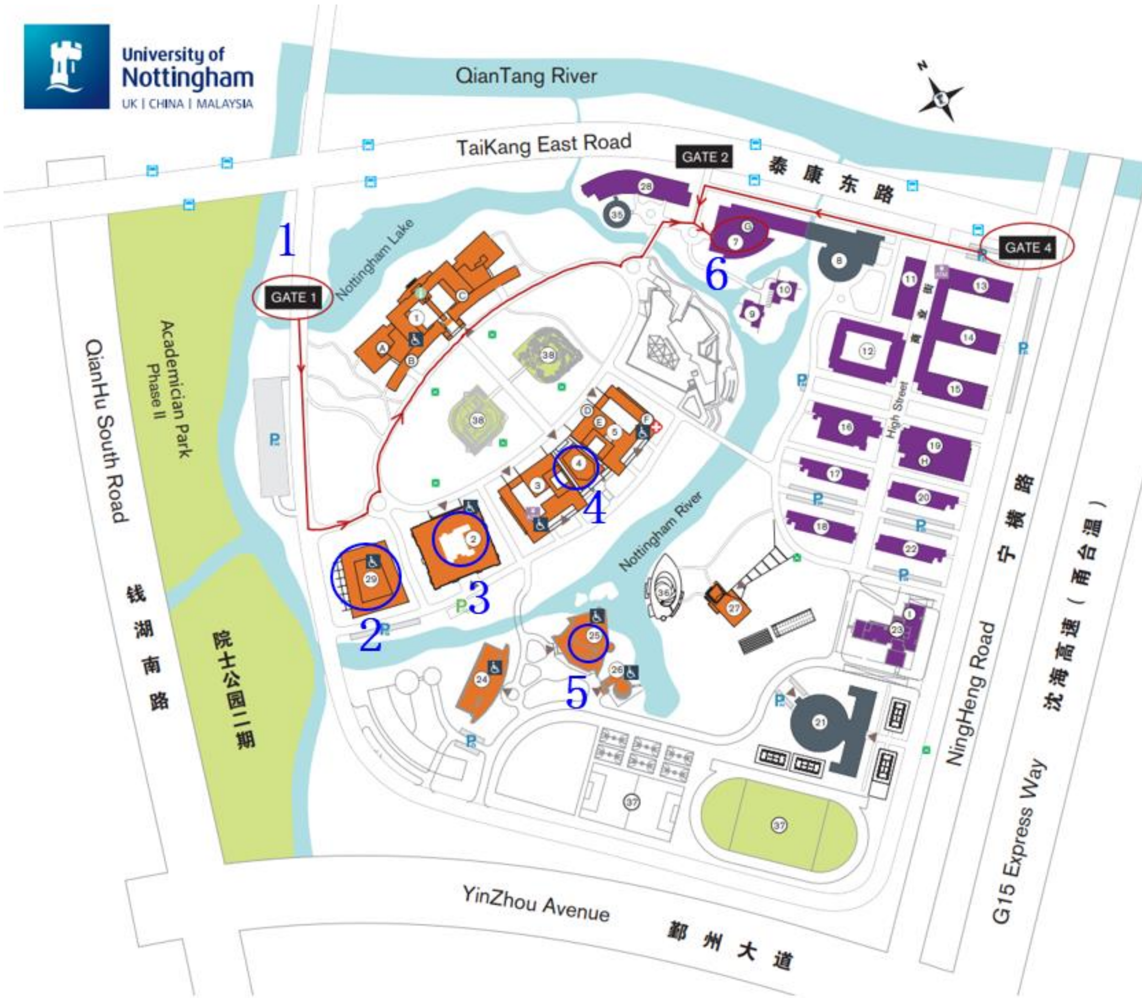
#9: Multiple Phase Flow and Renewable Energy
Join Zoom Meeting
https://unnc.zoom.com.cn/j/68319059664?pwd=d0MxOTZkMFFIMVo0UUhzbzNMZkNOdz09
Meeting ID: 683 1905 9664
Password: 220511

#10: Transport of Electrons and Phonons & LBM
Join Zoom Meeting
https://unnc.zoom.com.cn/j/64103853897?pwd=cTFZQlQxcUhpcXJQMmV2V1ZPVjlRQT09
Meeting ID: 641 0385 3897
Password: 155504

#11: Heat and Mass Transfer in Advanced Materials
Join Zoom Meeting
https://unnc.zoom.com.cn/j/64031864232?pwd=YnlwMEg1WHF5R2NhaVA4SzN6eFhZQT09
Meeting ID: 640 3186 4232
Password: 495879

#12: Thermal Fluid Dynamics
Join Zoom Meeting
https://unnc.zoom.com.cn/j/62215498225?pwd=bEZsemwxeGRSNU1renVQZEV3R21HQT09
Meeting ID: 622 1549 8225
Password: 423035

Campus Map



1. Gate 1

2. International Academy for Marine Economy and Technology (IAMET Building)
   (Sir David and Lady Susan Greenway Building)

3. Building of Faculty of Science and Engineering (PMB)
   (The Sir Peter Mansfield Building)

4. Siyuan Auditorium

5. New Auditorium
   (The D.H. Lawrence Auditorium)

6. Boya International Exchange Center (LA Hotel)

Program Overview

ISNMHMT2020 Program			
Time	Friday, December 11th, 2020		
12:00-20:00	1st Floor, Boya International Exchange Center (LA Hotel)		Onsite Registration
Time	Saturday, December 12th, 2020		
8:30-9:00	D.H. Lawrence Auditorium Host: Dr Yong Ren	Opening Ceremony: Welcome Speech by Prof. Patrick Chau; Opening Remarks by Prof. Yuying Yan and Prof. Bingyang Cao	
9:00-9:35	D.H. Lawrence Auditorium Host: Prof. Bingyang Cao	Plenary Lecture 1 (online)	Nonlinear Computation *Prof. Liqiu Wang, The University of Hong Kong*
9:35-10:10	D.H. Lawrence Auditorium Host: Prof. Hua Bao	Plenary Lecture 2 (online)	Predictive Simulations of Modal Phonon and Photon Transport Properties *Prof. Xiulin Ruan, Purdue University*
10:10-10:30	Group Photo and Coffee Break		
10:30-11:05	D.H. Lawrence Auditorium Host: Prof. Cunliang Liu	Plenary Lecture 3 (on-site)	Photothermally Induced Phase Change of Droplet and Its Interfacial Phenomena *Prof. Rong Chen, Chongqing University*
11:05-11:40	D.H. Lawrence Auditorium Host: Prof. Zixuan Yang	Plenary Lecture 4 (online)	Effect of Oxide Layer on Spray Cooling of a Hot Surface *Prof. Masamichi Kohno, Kyushu University*
12:00-14:00	Lunch Break		
14:00-14:35	D.H. Lawrence Auditorium Host: Prof. Zhizhao Che	Plenary Lecture 5 (online)	Freezing of Droplets on a Cold Surface: dynamic shape changes, spreading, and active control *Prof. Chun Yang, Nanyang Technological University*
14:45-17:10	Parallel Sessions I		
	IAMET-121	Transport Phenomena of Droplet Session Chair: Prof. Yuan Dong; Prof. Zhizhao Che	
	IAMET-218	Advanced Thermal Management Session Chair: Prof. Cunliang Liu; Prof. Cheng Zhang	
	IAMET-326-1	Multiple Phase Flow and Renewable Energy Session Chair: Prof. Hongtao Xu; Prof. Wee-Liat Ong	
	IAMET-301	Transport of Electrons and Phonons & LBM Session Chair: Prof. Menglian Zheng; Dr Yong Ren	
	PMB432	Heat and Mass Transfer in Advanced Materials Session Chair: Prof. Hua Bao; Prof. Yangsu Xie	
	PMB433	Thermal Fluid Dynamics Session Chair: Prof. Yanxin Hu; Dr Liang Xia	
18:00-20:30	Conference Banquet		

<table>
<tr><th>Time</th><th colspan="3">Sunday, December 13th, 2020</th></tr>
<tr><td>8:30-9:05</td><td>Siyuan Auditorium
Host: Prof. Yanan Yue</td><td>Plenary Lecture 6 (online)</td><td>Anisotropic Thermal Conductivities and Structure Inlignin-Based Microscale Carbon Fibers
Prof. Xinwei Wang, Iowa State University</td></tr>
<tr><td>9:05-9:40</td><td>Siyuan Auditorium
Host: Prof. Wee-Liat Ong</td><td>Plenary Lecture 7 (online)</td><td>An Asymmetric Converging-Diverging Channel Based Microfluidic Rectifier for Newtonian Fluids
Prof. Zhigang Li, The Hong Kong University of Science and Technology
(A recorded video will be played)</td></tr>
<tr><td>9:40-10:00</td><td colspan="3">Coffee Break</td></tr>
<tr><td>10:00-10:35</td><td>Siyuan Auditorium
Host: Dr. Yong Ren</td><td>Plenary Lecture 8 (on-site)</td><td>Phonon-Electron Coupling Characteristic and Thermoelectric Optimization in Nanoscale Low-Dimensional Materials
Prof. Guihua Tang, Xi'an Jiaotong University</td></tr>
<tr><td>10:35-11:10</td><td>Siyuan Auditorium
Host: Dr. Yong Ren</td><td>Plenary Lecture 9 (online)</td><td>Innovations at Interfaces for Water Energy Harvesting
Prof. Zuankai Wang, City University of Hong Kong</td></tr>
<tr><td>11:10-11:45</td><td>Siyuan Auditorium
Host: Prof. Yuan Dong</td><td>Plenary Lecture 10 (on-site)</td><td>Smooth Transition Across Liquid-Like, Tao-Phase-Like and Gas-Like Regimes by Croosing Two Transition Temperatures
Prof. Jinliang Xu, North China Electric Power University</td></tr>
<tr><td>12:00-14:00</td><td colspan="3">Lunch Break</td></tr>
<tr><td>14:00-14:35</td><td>Siyuan Auditorium
Host: Prof. Zhen Yang</td><td>Plenary Lecture 11 (online)</td><td>Pool Boiling Review: Fundamentals and Heat Transfer Enhancement
Prof. Tassos G. Karayiannis, Brunel University London
Dr Mohamed M. Mahmoud, Zagazig University</td></tr>
<tr><td rowspan="7">14:45-17:10</td><td colspan="3">Parallel Sessions II</td></tr>
<tr><td>IAMET-121</td><td colspan="2">Transport Phenomena of Droplet
Session Chair: Prof. Zhen Yang; Prof. Jianli Wang</td></tr>
<tr><td>IAMET-218</td><td colspan="2">Advanced Thermal Management
Session Chair: Prof. Yunhua Gan; Prof. Wei Li</td></tr>
<tr><td>IAMET-326-1</td><td colspan="2">Multiple Phase Flow and Renewable Energy
Session Chair: Prof. Mingzhou Yu; Prof. Zhiyuan Jiang</td></tr>
<tr><td>IAMET-301</td><td colspan="2">Transport of Electrons and Phonons & LBM
Session Chair: Prof. Yong Shi; Prof. Xiaojing Ma</td></tr>
<tr><td>PMB432</td><td colspan="2">Heat and Mass Transfer in Advanced Materials
Session Chair: Prof. Ronghui Qi; Prof. Xueliang Wang</td></tr>
<tr><td>PMB433</td><td colspan="2">Thermal Fluid Dynamics
Session Chair: Prof. Yanan Yue; Prof. Tianshu Ge</td></tr>
</table>

Transport Phenomena of Droplet, IAMET-121 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Yuan Dong, Zhizhao Che	
14:45-15:10	**Keynote Speech: Macrotextures for Efficient Condensate Droplet Removal**	**Yaqi Cheng * Dalian University of Technology (on behalf of Prof. Xuehu Ma)**
15:10-15:35	**Keynote Speech: Molecular Dynamics Simulation on Wetting of Mixture Droplet**	**Zhen Yang Tsinghua University**
15:35-15:50	Mixing Characteristics of Droplets in Bumpy Serpentine Microchannel	Xiang Cao Southeast University
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Effects of particles on Flow and Heat Transfer of Fluids**	**Fang Liu* Shanghai University of Electric Power (A recorded video will be played)**
16:45-17:10	**Keynote Speech: Interface Resolving Simulations of Flow Boiling in Microchannels**	**Mirco Magnini* University of Nottingham**
17:10-17:25	Molecular Dynamics Simulation on Thermal Conduction and Rectification across Molecular Bridge	Chenghao Diao Tsinghua University
Transport Phenomena of Droplet, IAMET-121 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Zhen Yang; Jianli Wang	
14:45-15:10	**Keynote Speech: Some Fundamental Researches on Droplet Icing and Deicing Phenomena**	**Fuqiang Chu* University of Science and Technology Beijing**
15:10-15:35	**Keynote Speech: Numerical Simulation of Droplet Impact Phenomena**	**Zhizhao Che Tianjin University**
15:35-16:00	**Keynote Speech: A relook into thermal rectification in mass-graded carbon nanotubes**	**Wee-Liat Ong Zhejiang University-University of Illinois at Urbana-Champaign Institute**
16:00-16:20	Coffee Break	
16:20-16:35	On the Effect of Droplets' Size on the Efficiency of Water-Based Fire Suppression Systems with A Novel Stochastic Approach	Hengrui Liu University of New South Wales
16:35-16:50	Numerical Simulation of Triple Emulsion Droplet Generation in A Flow-Focusing Microchannel	Wei Yu Yangzhou University

Advanced Thermal Management, IAMET-218 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Cunliang Liu; Cheng Zhang	
14:45-15:10	**Keynote Speech: Analogy Principle for Overall Cooling Effectiveness of Turbine Blade and Numerical Validation**	**Cunliang Liu Northwestern Polytechnical University**
15:10-15:35	**Keynote Speech: Manipulating Conductive and Convective Heat Transfer at the Nanoscale**	**Qinyi Li * Kyushu University**
15:35-16:00	**Keynote Speech: The Contribution of Microlayer Evaporation to Boiling Heat Transfer during Nucleate Pool Boiling**	**Zhihao Chen Tianjin University**
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Research Progress on Heat and Mass Transfer Characteristics of Desiccant Coated Heat Exchanger**	**Tianshu Ge Shanghai Jiao Tong University**
16:45-17:10	**Keynote Speech: Numerical Analysis on A Thermal Management System for A Battery Pack with Cylindrical Cells Based on Heat Pipes**	**Yunhua Gan South China University of Technology**

Advanced Thermal Management, IAMET-218 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Yunhua Gan; Wei Li	
14:45-15:10	**Keynote Speech: Manufacturing Process and Thermal Performance of 0.4 Mm Thick Ultra-Thin Vapor Chamber**	**Yong Li * South China University of Technology**
15:10-15:25	CFD Study of Cavitation and Flash Boiling in GDI Nozzle	Xinyu Zhang University of Nottingham Ningbo China
15:25-15:50	**Keynote Speech: Self-Adaptive Devices by Heat-Responsive Polymers**	**Cheng Zhang University of Missouri**
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Numerical Study of Manifold Microchannel Flow Boiling**	**Wei Li Zhejiang University**
16:45-17:10	**Keynote Speech: The Collocation Spectral Method for Radiative Heat Transfer with Domain Decomposition**	**Ruirui Zhou * University of Shanghai for Science and Technology**

Multiple Phase Flow and Renewable Energy, IAMET-326-1 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Hongtao Xu; Wee-Liat Ong	
14:45-15:10	**Keynote Speech: Tuning Spectral Selectivity of Solar Absorbing Surfaces for Control of Interfacial Phenomena**	**Weihong Li * The Hong Kong University of Science and Technology**
15:10-15:35	**Keynote Speech: Comparison Between 2D and 3D Numerical Simulations of Melting in Containers Towards Thermal Energy Storage**	**Liwu Fan Zhejiang University**
15:35-16:00	**Keynote Speech: Method of Moments for Resolving Polydispersed Particle-laden Flows**	**Mingzhou Yu China Jiliang University**
16:00-16:20	Coffee Break	
16:20-16:35	Effect of The Throat Structure on Critical Back Pressure in the Ejector Refrigeration System Based on Numerical Simulation	Yu Han Suqian University
16:35-16:50	Numerical Investigation of Slot Jet Impingement: Comparison of Reverse and Flat Targets	Abdallah Ahmed* University of Nottingham and Cairo University
16:50-17:05	Synthesis of Microparticles by Microfluidic Emulsification for Water Treatment	Zheng Lian University of Nottingham Ningbo
Multiple Phase Flow and Renewable Energy, IAMET-326-1 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Mingzhou Yu; Zhiyuan Jiang	
14:45-15:10	**Keynote Speech: The System Performance Characterization of Phase Change Heat Transfer and Related Experimental Study**	**Hongtao Xu University of Shanghai for Science and Technology**
15:10-15:25	Optimization of A Latent Heat Storage Unit with Gradient Fins	Xuan Zhang Southeast University
15:25-15:40	Theoretic Analysis of Dish Solar Stirling CHP Cycle Considering Temperature Irreversibility	Xiaotian Lai Huazhong University of Science and Technology
16:00-16:20	Coffee Break	
16:20-16:35	A Novel Bionic Packed Bed Latent Heat Storage System Filled with Encapsulated Pcm For Thermal Energy Collection	Xiangzhi Zhang University of Nottingham Ningbo China
16:35-16:50	Effects of Vortices Induced Shear on Macro-Mixing In A Taylor-Couette Flow Reactor With Non-Circular Cross-Section Inner Cylinder	Chenyang Xue University of Nottingham Ningbo China

Transport of Electrons and Phonons & LBM, IAMET-301 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Menglian Zheng; Yong Ren	
14:45-15:10	**Keynote Speech: Lattice Boltzmann Method for Oscillatory Flows at The Micro and Nanoscale**	**Yong Shi University of Nottingham Ningbo China**
15:10-15:35	**Keynote Speech: Continuum Modeling, Analysis and Simulations of Charge Transport in Porous Nanomaterials**	**Yue Chan* Shenzhen University**
15:35-15:50	A Multi-Physics Coupled Model for Prediction of The Ampacity of Direct Buried Power Cables in Soil	Yanhao Feng Zhejiang University
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Local Porosity and Microstructure Optimization for Redox Flow Battery Electrode**	**Menglian Zheng Zhejiang University**
16:45-17:00	Strong Electron-phonon Coupling Effects on Heat Conduction in 2D metallic Mxene	Ao Wang Shanghai Jiao Tong University
Transport of Electrons and Phonons & LBM, IAMET-301 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Yong Shi; Xiaojing Ma	
14:45-15:10	**Keynote Speech: 3D-Lbm Simulations of Surface Structure Effects on Pool Boiling**	**Xiaojing Ma North China Electric Power University**
15:10-15:35	**Keynote Speech: Numerical Simulation for A Bubble on the Vertical Flat Surface by Lattice Boltzmann Model**	**Tomohiko Yamaguchi * Nagasaki University**
15:35-16:00	**Keynote Speech: A Lattice Boltzmann Study of Density-Driven Instabilities in CO_2 Sequestration in Saline Aquifers**	**Gaojie Liu * University of Shanghai for Science and Technology**
16:00-16:20	Coffee Break	
16:20-16:35	Phase-Field Lattice Boltzmann Model for Binary Fluid Flows	He Wang Southeast University
16:35-16:50	A Hybrid LB-FD Method for Non-Fourier Heat Conduction	Yi Liu Southeast University

Heat and Mass Transfer in Advanced Materials, PMB432 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Hua Bao; Yangsu Xie	
14:45-15:10	**Keynote Speech: Investigations on Heat and Mass Transport in Porous Electrode and Battery Thermal Management for A Wide Temperature Range**	**Zhiyuan Jiang Xi'an Jiaotong University (on behalf of Prof. Zhiguo Qu)**
15:10-15:35	**Keynote Speech: Heat and Mass Transfer Modelling and Performance Analysis of Polymeric Electrolyte Membrane-Based Electrolytic Air Dehumidification**	**Ronghui Qi South China University of Technology**
15:35-16:00	**Keynote Speech: Physical Insights from Diffuse-interface Modeling of Boiling on Biphilic Surfaces**	**Biao Shen * University of Tsukuba**
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: An Efficient Transient Heat Transfer Model for Parallel Cooling System and Its Application for System Design**	**Kai Chen* South China University of Technology**
16:45-17:00	Pore-Scale Simulation of Miscible Displacement with Dissolution in Anisotropic Porous Media by Lattice Boltzmann Method	Ziyu Shao* University of Shanghai for Science and Technology
Heat and Mass Transfer in Advanced Materials, PMB432 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Ronghui Qi; Xueliang Wang	
14:45-15:10	**Keynote Speech: Thermal Transport Properties in Metals and Metallic Nanostructures**	**Hua Bao Shanghai Jiao Tong University**
15:10-15:35	**Keynote Speech: Multi-Pace Heat Conduction in Carbon Nanotube Bundles Induced by Structure Separation**	**Yangsu Xie Shenzhen University**
15:35-16:00	**Keynote Speech: Evolution of A Sedimenting Colloidal Sheet**	**Ruoyu Dong * Institute for Basic Science**
16:00-16:20	Coffee Break	
16:20-16:35	Machine Learning Applied to Predict Thermo-Physical Properties of Carbon-Based Magnetic Nanofluids	Lei Shi Harbin Institute of Technology and University of Nottingham
16:35-16:50	CFD Study of Spray Cooling with Flash Evaporation in Spacecraft	Xinyu Zhang University of Nottingham Ningbo China

Thermal Fluid Dynamics, PMB433 Saturday, December 12th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Yanxin Hu; Liang Xia	
14:45-15:10	**Keynote Speech: Application of Differential Heat Conduction on Microscale Characterization of Localized Heat Convection Effect**	**Yanan Yue Wuhan University**
15:10-15:35	**Keynote Speech: A Novel Numerical Solver for Incompressible Two-Fluid Flows at High Reynolds Numbers**	**Zixuan Yang Chinese Academy of Sciences**
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Numerical Simulation of Vertical U-Tube Natural Recirculation Steam Generators and Optimization of Corrugated-Plate Moisture Separator**	**Xinyu Zhang University of Nottingham Ningbo China**
16:45-17:00	A Study on Particulate Matter Concentrations in METRO Stations of Ningbo City	Xuanhao Zhu * University of Nottingham Ningbo China
Thermal Fluid Dynamics, PMB433 Sunday, December 13th, 2020 Online presentation is annotated by asterisk		
Session Chair:	Yanan Yue; Tianshu Ge	
14:45-15:00	Effective Pressure Tuning on Thermal Transport Properties of Platinum	Xinyu Zhang Shanghai Jiao Tong University
15:00-15:25	**Keynote Speech: Experimental Measurement and Numerical Modelling of Freezing Process of Chicken Burger Patties During Impingement Quick Freezing**	Liang Xia University of Nottingham Ningbo China
15:25-15:40	Heat Transfer Enhancement in A Liquid Piston Gas Compressor	Mansoureh Khaljani * Queen's University Belfast
16:00-16:20	Coffee Break	
16:20-16:45	**Keynote Speech: Development and Validation of Computational Fluid Dynamics Modelling for Carbon Dioxide (CO_2) Condensation in High-Pressure Supersonic Flows**	**Chuang Wen * University of Nottingham**
16:45-17:00	Pore Scale Simulation of Turbulent Flow in A Composite Porous-Fluid System	Mohammad Jadidi * Queen's University Belfast

Plenary Speakers

Prof. Guihua Tang	
Xi'an Jiaotong University	
ghtang@mail.xjtu.edu.cn	
Phonon-Electron Coupling Characteristic and Thermoelectric Optimization in Nanoscale Low-Dimensional Materials	

Abstract:

The lattice thermal conductivity of silicon nanostructures considering electron-phonon scattering is investigated for comparing the lattice thermal conductivity reductions from nanostructuring technology and the carrier concentration optimization. We performed frequency-dependent simulations of thermal transport systematically in nanowires, solid thin films and nanoporous thin films by solving the phonon Boltzmann transport equation with the discrete ordinate method. All the phonon properties are based on the first-principle calculations. The results show that nanostructuring technology and carrier concentration optimization method can be selected or combined more efficiently to reduce the thermal conductivity of TE materials.

Low-dimensional materials have an excellent prospect in thermoelectric applications. We investigated the geometric structure, band structure and electron transport properties of hydrogenated and pure multilayer silicene using first principle calculation within density functional theory. The Boltzmann theory for electrons under relaxation time approximation was employed to obtain the Seebeck coefficient and electrical conductivity. The calculations of electron relaxation time were based on the deformation potential theory. By combining the adjustment of the hydrogenation ratio with the method of changing the geometric structure, a high thermoelectric performance can be achieved in multilayer silicene.

Two-dimensional SnSe monolayers have an excellent prospect in thermoelectric applications. We investigated the structure, electron and phonon properties of 2D monolayer SnSe doped with 1D Mn nanowires using the first principle calculation within density functional theory. The Boltzmann theory for electrons under relaxation time approximation was employed to obtain the Seebeck coefficient and electrical conductivity. The lattice thermal conductivity was calculated using the Boltzmann Transport Equation method and the Debye-Callaway model. The results show that the doping of 1D Mn nanowires can enhance the phonon scattering process by introducing wire defects, and reduce the lattice thermal conductivity. By adjusting the width between nanowires, record high *ZT* values from 0.71 at 200 K to 3.76 at 650 K are achieved, 37.8% larger than the intrinsic monolayer SnSe on average. This work was supported by the National Natural Science Foundation of China under grant numbers of 51825604 and 51721004, and 111 Project under grant number of B16038.

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Biography:

Professor Guihua Tang is currently Director of Key Laboratory of Thermo-Fluid Science and Engineering, Ministry of Education in China, Xi'an Jiaotong University. He obtained a PhD in Power Engineering and Engineering Thermophysics in 2004, and BEng in 1996 from Xi'an Jiaotong University. He worked as a Higher Scientific Officer in the UK STFC Daresbury Laboratory from 2007 to 2009. He has extensive research experiences in microscale and nanoscale fluid flow and heat transfer and the applications in solar energy, thermoelectrics materials, super-thermal insulating materials, and phase-change heat transfer. He has published over 100 peer-reviewed international journal papers. Currently he serves as Associate Editor for the ASME Journal of Heat Transfer. He was awarded with Chung-Hua Wu Award by the Chinese Society of Engineering Thermophysics, New Century Excellent Talents in University of China, Excellent Young Scholars and Distinguished Young Scholars from the National Natural Science Foundation of China, "Ten thousand plan" - National high level talents special support plan of China, etc.

Prof. Rong Chen

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Photothermally Induced Droplet Evaporation and Interfacial Phenomena

Abstract:

The photothermal effect, which can directly convert the light energy to the heat, is one of important fluid-light interactions, which can be potentially applied to various fields, including analytical and biochemical chemistry, materials synthesis and so on. In particular, the photothermal effect induced phase change and the accompanying interfacial behaviors have been used to enable the manipulation of fluids. This presentaton mainly talks about the droplet evaporation and interfacial phenomena induced by the photothermal effect of a focused infrared laser. The achieved results are expected to be helpful for the future applications of the photothermal effect based droplet microfluidcs.

Biography:

Dr. Rong Chen received his PhD in Mechanical Engineering from the Hong Kong University of Science and Technology in 2007 and joined School of Energy and Power Engineering of Chongqing University in 2010. He has been awarded Nation Science Foundation of China for Distinguished Young Scholars, Chang Jiang Scholars Program for Young Scholars, Innovation Leaders of National Special Support Program for High Level Talents. Currently, He has published more than 100 peer-reviewed papers in the international journals. His research interests mainly cover the solar utilization by photochemistry, optofluidics, new energy technologies, micro-scale transport and interfacial phenomena as well as the heat/mass transport in porous media.

Prof. Masamichi Kohno

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Effect of Oxide Layer on Spray Cooling of a Hot Surface

Abstract:

The spray cooling process has an important role in the steel production process as it affects the quality of the steel such as its strength/ductility. Moreover, when the temperature distribution inside the steel sheet becomes non-uniform during the spray cooling process, deformation and cracking occurs. Therefore, uniform cooling is important to obtain a high-quality steel sheet. Fig.1 shows a typical cooling curve of the spray cooling process. Here, Y-axis corresponds to the temperature of the surface, and X-axis corresponds to the cooling time. At high temperature region, droplet is elevated from the surface due to the formation of a vapor film. This vapor film acts as a thermal insulator between the droplet and the surface, which leads to the gradual decrease in the surface temperature. As the surface temperature further decreases, the droplet-surface contact time increases along with a corresponding increase in the surface heat flux. This regime is defined as the transition-boiling regime. Once the surface temperature reaches "Quenching point", the surface temperature drops abruptly due to the liquid droplet effectively wetting the surface. The further decrease in surface temperature leads to the heat transfer by single-phase convection. As the surface temperature drops drastically at the "Quenching point", it is crucial to control the "Quenching point" to manage the spray cooling process. However, since there are many factors that affect the cooling characteristics, both in the cooling water and the object to be cooled, it is very difficult to control the "Quenching point".

In this study, we focused on the effects of an oxide film on the surface on spray cooling process. Two types of samples were prepared for the experiments, one with an iron-based oxide film formed on the surface of pure iron and the other without it. Then, the effect of the iron oxide film on the cooling characteristics were evaluated from the temperature history. An oxide film of thickness ~30 μm was grown by controlling the temperature, atmosphere and heating time in the chamber. The spray cooling experiment was conducted in a controlled environment chamber to avoid further oxidation of the sample surface. The data were analysed not only for determining the surface temperature but also for calculating the contact surface temperature, assuming the transient heat conduction for a contact between two semi-finite bodies. We found that the presence of the oxide layer helps in the faster cooling of the surface. In the presentation, the effects of oxide layer on spray cooling, and how oxide layer affects the "Quenching point" will be discussed.

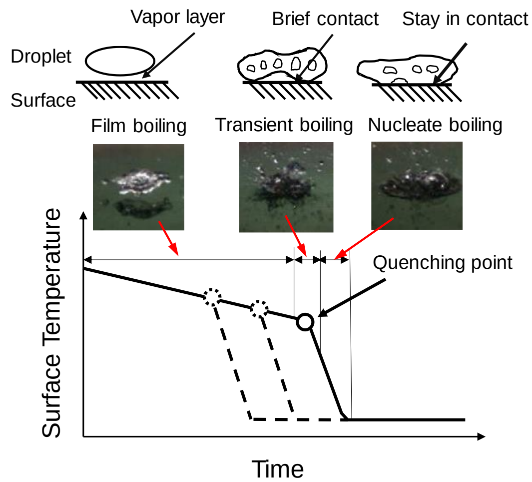

Fig.1 Typical example of a cooling curve on spray cooling of a hot surface. Quenching point varies depending on the cooling conditions.

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Biography:

Prof. M. Kohno obtained his PhD from Tokyo Metropolitan University (1998), Japan, and is currently Professor in the Department of Mechanical Engineering, Kyushu University (From 2017). He also serves as Professor in International Institute for Carbon-Neutral Energy Research (I2CNER), Kyushu University. From 1998 to 2001, He joined as a research associate, in the Department of Mechanical Engineering, The University of Tokyo (Prof. Shigeo Maruyama's lab). He developed alcohol CVD method for SWNT (Single-Walled-Carbon-Nanotube) that is one of the most popular SWNT synthesis method nowadays. He received JSME (The Japan Society of Mechanical Engineers) medal for outstanding paper for the method. From 2001 to 2004, he joined The National Institute of Advanced Industrial Science and Technology (AIST, Prof. Akira Yabe's lab) as a Postdoctoral Fellow. He investigated laser micro processing using Bessel laser beam especially for microscale drilling technique. In 2004 he assigned to an Associate Professor, Department of Mechanical Engineering, Kyushu University (Prof. Yasuyuki Takata's lab). From 2006, he was involved research activities in Research Center for Hydrogen Industrial Use and Storage, Kyushu University. His research topic was measurement of thermophysical property of hydrogen at high pressure and high temperature. From 2012 to 2013, he worked in University of Illinois at Urbana Champaign as a visiting scholar. He is member of JSME, Heat Transfer Society of Japan, Japan Society of Thermophysical Properties etc. His running research project are 1. Effect of surface properties on spray cooling process. 2. Development of material property using HPT (High Pressure Torsion). 3. Observation of interface between liquid and solid in nanoscale by TEM (Transmission Electron Microscopy). 4. Measurement of thermophysical properties of nano-carbon materials by Raman spectroscopy.

Prof. Chun Yang

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Freezing of Droplets on a Cold Surface: dynamic shape changes, spreading, and active contro

Abstract:

Icing of structures is a major hazard from aviation (e.g. aircraft icing), to energy production (e.g. icing on wind turbines), to maritime (e.g. shipping, offshore oil rigs), to thermal systems (e.g., heat pumps, cold storage). Icing is usually resulted from a droplet impacting/depositing onto a cold surface and then freezing on the surface. Traditionally active methods such as thermal, mechanical, or chemical treatment have been used to mitigate icing or de-ice a structure. These methods are usually energy and labor intensive, or for some applications not feasible and effective. In the past decade, the use of coatings of various materials for mitigating icing or de-icing, has been explored. Often wettability of coatings is used as a key indicator for its effectiveness in aiding with de-icing or mitigating the icing. This is due to the fact that wettability of a surface influences how a droplet will remain or can be removed from a surface, and also surface wettability will determine the nucleation sites for ice or frost to form, which in turn will cause freezing of the water on the surface. Therefore, the phenomenon of droplet freezing on a substrate surface exhibits the strong coupling of multi-physics including droplet impact dynamics, surface wetting, and substrate cooling with phase change. This talk will discuss the freezing characteristics of deposited and impacting water droplets and nanofluids droplets under the effects of surface wettability, substrate temperature, impact velocity as well as an externally applied field. Both experimental and numerical simulation results will be reported.

Biography:

Dr. Chun Yang is Professor and Associate Chair in the School of Mechanical and Aerospace Engineering at the Nanyang Technological University (NTU). He received his Ph.D degree from University of Alberta, Master's degree in Engineering Thermophysics from University of Science and Technology of China, and Bachelor's degree in Thermal Engineering from Tsinghua University. In December 1999, he joined NTU where he has carried out extensive experimental, theoretical and numerical studies of micro- and nano-scale thermofluid transport with emphasis on interfacial effects. His current research interests include: Microscale fluid flow and heat and mass transfer; Microfluidics for Lab-on-Chip devices; Nanofluids phase change for cold energy storage; Icing, anti-icing and deicing; Deposition, interactions, and manipulations of colloidal particles; Forward osmosis for green energy generation. He has published more than 220 journal papers and 20 book chapters. According to ISI Web of Science, his published works are highly cited with an H-index of 43 and a total citation > 8500 times. He is an elected ASME Fellow, and currently is an Editorial advisory board member for Microfluidics and Nanofluidics (Springer-Verlag Publishers) and Experimental Results (Cambridge Press), and an Editor for International Communications on Heat and Mass Transfer (Elsevier).

Prof. Jinliang Xu

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Smooth Transition Across Liquid-Like, Tao-Phase-Like And Gas-Like Regimes By Croosing Two Transition Temperatures

Abstract:

The academic term of Multiphase is related to various nature phenomena and engineering applications. Classically, supercritical fluid SF is regarded as a single-phase fluid such as documented in textbooks. Alternatively, SF is believed to have a sharp transition across liquid-like LL and gas-like GL by crossing the Widom line. Because both LL and GL belong to the single-phase fluid, and bubbles are never reported for pressures far above the critical value, supercritical fluid and subcritical fluid are thought to be different. The current knowledge on SF limits the large scale utilizations of supercritical technologies. In this presentation, we report the progress on the studies of phase distributions and their transition boundaries in SF, using molecular dynamics simulation technique. We show that SF can be divided into three regimes, liquid-like, two-phase-like and gas-like, interfaced by an onset pseudo-boiling temperature Ts and a termination pseudo-boiling temperature Te. We determine Ts and Te using three different approaches, and find consistent outcomes which also match the thermodynamics determined values. We discover nanobubbles in a temperature span between Ts and Te, an unexpected cognition on supercritical fluid structure. Nonlinear dynamics demonstrates the chaotic behavior in two-phase-like regime, similar to two-phase regime in subcritical domain. Our work highlights the common feature of bubbles in both supercritical and subcritical pressures, establishing a strong connection between the two ranges of pressures. Hence, one could introduce the well-established multiphase theory in subcritical domain to the study of the complicated SF. We believe that our present work not only enhances the fundamental understanding of SF, but also is useful to the development of supercritical technologies.

Biography:

Prof. Jinliang Xu is the Director of Beijing Key Laboratory of Multiphase Flow and Heat Transfer for Low Grade Energy Utilization, North China Electric Power University. He joined Guangzhou Institute of Energy Conversion from 2002, and setup the Micro Energy System Laboratory there. He joined North China Electric Power University in 2009 and founded the Beijing Key Laboratory of Multiphase Flow and Heat Transfer for Low Grade Energy Utilizations. His research interest includes multiphase flow and heat transfer in micro/nano systems, advanced power generation system, low grade energy and renewable energy utilization. He published more than 200 international journal papers as the corresponding author and co-authored two books. He has been the highly cited author in recent five years in Energy field. He has been the chair or co-chair for a set of academic conferences such as 4th Micro and Nano Flows Conference (University College London, UK, 7-10 September 2014), IHTS 2014 (International Heat Transfer Symposium 2014, Beijing) and first Int. Conference on supercritical

CO2 power system (2018 Being) etc. He is the editor of the journals of Energies, Thermal Science and Engineering Progress, Frontiers in Heat pipe, Alternative Energy. He is the guest editor for the special issue of Applied Thermal Engineering and Energy. He presented 40 keynote speeches in international conferences, and has been the reviewer for more than 30 journals. He was the best reviewer of the Journal of Heat Transfer, ASME in the fiscal year of 2012. He received the Natural Science Award of the Ministry of Education, China (first grade). He has been the “973” project chief scientist, Ministry of Science since 2011 and was named as the “Yangtze River Scholar” Professor by the National Ministry of education, China in 2013.

Prof. Zhigang Li

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An Asymmetric Converging-diverging Channel Based Microfluidic Rectifier for Newtonian Fluids

Abstract:

Flow rectification for Newtonian fluids using fixed structures is a challenging problem. In the past decades, many efforts have been made to develop microfluidic rectifiers using asymmetric structures. The performance of flow rectifiers is characterized by the flow rate (or flow resistance) ratio between the forward and backward directions, which is termed as diodicity (Di). Most of the previous microfluidic rectifiers can reach a reasonable diodicity if non-Newtonian fluids are employed [1,2]. For Newtonian fluids, however, the diodicity drops greatly or even vanishes [2]. In the literature, the flows are basically in the transitional regime and the highest Di of microfluidic rectifiers for Newtonian fluids is 1.54, which is realized using a microchannel with sudden expansions and embedded block structures [3]. To achieve flow rectification for Newtonian fluids, a high Re is required. This, at the microscale, is quite difficult due to the small size of flow channels. To improve the diodicity of Newtonian fluid based microfluidic rectifiers, turbulent flows at relatively low Re are necessary. This can be accomplished by varying the structure of the flow channels. In this work, we fabricate a microfluidic rectifier for Newtonian fluids using asymmetric converging-diverging microchannels (ACDMCs). The highest diodicity measured for the rectifier is 1.77, which is 15-54% higher than previous microfluidic rectifiers for Newtonian fluids. Flows in the ACDMCs are characterized and an expression for the diodicity is also developed based on two scaling laws for the flow resistances in the forward and backward directions.

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Biography:

Dr. Zhigang Li is currently a professor in the Department of Mechanical and Aerospace Engineering at the Hong Kong University of Science and Technology (HKUST). He received his B.S. from Harbin Engineering University in 1996, M.Eng. from Tsinghua University in 1999, and Ph.D. from the University of Delaware in 2005. Before moving to HKUST in 2007, he was a post-doctoral research associate in the Department of Chemical & Biomolecular Engineering at the Johns Hopkins University. He was a recipient of the Chinese Government

Award for Outstanding Oversea Student (2005), K.C. Wong Education Foundation award (2019), and distinguished visiting scholar award of University of Macau (2019). His research interest covers several areas, including nanoscale transport phenomena, interfacial science, nonlinear dynamics/chaos, and biosensors.

Prof. Liqiu Wang

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Nonlinear Computation

Abstract:

Topics such as bifurcation and chaos, methods such as continuation and branch switching, and features such as multiplicity, stability and sensitivity are fundamental in our attempt to understand the world. “Nonlinear Computation” is a short name for “computation of something that is nonlinear”. It provides a framework for the computational science and engineering of the future and is essential when we try to predict and simulate the dynamics of states in the technical systems we utilize, in the ecological and economical systems we live, and in the biological systems we belong. In this lecture, I will discuss key issues in nonlinear computation and show its capabilities by using examples like (1) convection in microchannels, (2) cooling systems of rotating machinery, (3) fabrication and manipulation of nanobubbles, nanodroplets, nanofluids and multifunctional mcirofibers, (4) thermal control system of the Alpha Magnetic Spectrometer (AMS) on the International Space Station, and (5) causative factors and the clinical applicability of spontaneous regression of malignant tumors.

Biography:

Prof. Liuqiu Wang received his PhD from University of Alberta, Canada, and is currently a Chair Professor in the Department of Mechanical Engineering, the University of Hong Kong (HKU). He also serves as the Director and the Chief Scientist for the Laboratory for Nanofluids and Thermal Engineering at the Zhejiang Institute of Research and Innovation (HKU-ZIRI), the University of Hong Kong. Prof. Wang has over 20 years of university experience in transport phenomena, materials, nanotechnology, biotechnology, energy & environment, thermal & power engineering, and mathematics, and ~2 years of industry experience in technology and IP development/management/transfer as the Chief Scientist & the Global CTO. In addition to 6 authored scholarly monographs/books, 4 edited scholarly monographs, 5 book chapters, 70+ keynote lectures at international conferences and 150+ Invited Speechs in universities/industries/organizations, Prof. Wang has published 460+ papers, many of which have been widely used by researchers all over the world, and been ranked amongst the top 1% of most-cited scientists according to Clarivate Analytics' Essential Science Indicator. Prof. Wang has also filed 30+ patents/software copyrights, and developed, with an international team consisting of about 100 scientists and engineers, a state-of-the-art thermal control system for the Alpha Magnetic Spectrometer (AMS) on the International Space Station (ISS) that ensures AMS and all its sub-detectors working at their designed temperatures ± 1 ℃ for an environment temperature variation from -40 ℃ to 60 ℃ every 90 minutes. Prof. Wang’s work has been widely featured by local, national and international media, and received recognition through a number of awards, including the 2018 TechConnect Global Innovation Award, the 2018 Silver

Medal of the International Exhibition of Inventions of Geneva, the 2017 OSA Innovation Award, the 2016 First Outstanding Achievement Award of Hangzhou Oversea Scholars, the 2012 Qianren (Zhejiang) Chair Professorship, and the 2010 Taishan Chair Professorship, among others.

Prof. Zuankai Wang

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Innovations at Interfaces for Water Energy Harvesting

Abstract:

Water covers about 70% of the earth's surface and contains tremendous renewable and clean energy. Despite success in the harvesting hydrodynamic energy based on heavy-weight and bulky electromagnetic generators, a great deal of water energies stored in the low frequency flow of water, such as in the form of raindrop, river/ocean wave, tide, remain largely untapped. In recent years, numerous promising techniques that allow for the efficient harvesting of water/liquid energy have emerged [1-3]. In this talk, I will discuss our recent progress in taking advantage of the fusion of slipperry surfaces and transistor-inspired architecture on the efficient water energy [4]. On the research line of liquid/liquid-interface based energy harvesting, we developed a novel slippery lubricant-impregnated porous surface (SLIPS) based TENG, termed as SLIPS-TENG, that exhibits distinctive advantages including optical transparency, self-cleaning, impact tolerance, flexibility, and enhanced power generation stability even under harsh environments [5]. On the research line of solid/liquid-interface based energy harvesting, we report an original droplet-based energy generator (DEG) with field effect transistor (FET)-like architecture that fundamentally overcomes the physical limitation inherent in the traditional approaches which are imposed by the undesirable interfacial effect and achieves the highest energy conversion efficiency [6]. Such a unique design allows for the reversible and efficient transfer of charges between the source and drain, resulting in the enhancement of power density by several orders of magnitude over its counterparts.

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Biography:

Dr. Zuankai Wang is a full professor in the Department of Mechanical Engineering and Associate Dean in the College of Engineering at the City University of Hong Kong. He earned B.S. degree in Mechanical Engineering from Jilin University in 2000 and Master degree in Microelectronics from Shanghai Institute of Microsystem and Information Technology, Chinese Academy of Sciences, in 2003, and Ph. D. degree in Mechanical Engineering at Rensselaer Polytechnic Institute in 2008. After one-year postdoc training in Biomedical Engineering at Columbia University, he joined in the City University of Hong Kong in September 2009 as an assistant professor. He is the founding member of Young Academy of Science of Hong Kong, fellow of the International Society of Bionic Engineering and Changjiang Chair Professor awarded by Ministry of Education of China. He has won many awards including the Xplorer Prize (2020), Hiwin Outstanding Doctoral Dissertation Supervisor Award (Silver, 2019), World Cultural Council Special Recognition Award (2018), Outstanding Youth Award from International Society of Bionic Engineering (2016), Outstanding Research Award (2017) and President’s Lectureship at the City University of Hong Kong (2018, 2020).

Prof. Xinwei Wang

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Anisotropic Thermal Conductivities and Structure in Lignin-based Microscale Carbon Fibers

Abstract:

It is very important to know whether the thermal conductivity of carbon fibers in the directions of fiber axis (axial thermal conductivity) and fiber radius (radial thermal conductivity) are anisotropic. Relevant study is strongly hindered by microsize of carbon fibers in the radial direction. This talk will introduce a novel method by combining frequency domain energy transport state-resolved Raman and transient electrothermal techniques to overcome this drawback and achieve thermal conductivity anisotropy study of lignin-based microscale carbon fibers. Four fibers are characterized and the difference of axial thermal conductivity among them is very small while the difference of radial thermal conductivity is very large. The significant variation of radial thermal conductivity reveals strong structure anisotropy and radial structure variation. The thermal conductivity variation against temperature also shows very different behavior. The axial thermal conductivity features a reduction of more than one order of magnitude from room temperature to 10 K while the radial thermal conductivity shows very little change from room temperature to 77 K. For the same carbon fiber, there is also a large difference of radial thermal conductivity at different axial positions. Detailed Raman study of the axial and radial structures uncovers very strong structure anisotropy and explains the observed anisotropic thermal conductivities.

Biography:

Dr. Xinwei Wang is a full professor at Iowa State University (http://web.me.iastate.edu/wang). He obtained his Ph.D. from the School of Mechanical Engineering, Purdue University in 2001, and had his M.S. (1996) and B.S. (1994) from the University of Science and Technology of China. Over the past 19 years, he has led his laboratory to develop novel technologies for micro/nanoscale thermal characterization, study ultrafast-laser material interaction, investigate light-structure coupling, and probe energy transport in various materials down the sub-nm scale. His current work focuses on energy transport in 2D atomic layer materials and atomic scale interface phonon energy transport. He has published more than 160 papers in highly-visible journals. He received the inaugural Viskanta Fellow Award of Purdue University in recognition of his pioneering and independent work in thermal sciences. He is the recipient of the 2014 Mid-career Award for Research of Iowa State University (ISU) and 2018 ISU Award for Outstanding Achievement in Research. He is the "Changjiang" Visiting Professor of University of Science and Technology of China, Fellow of American Society of Mechanical Engineers (ASME) and Associate Fellow of American Institute of Aeronautics and Astronautics (AIAA). He serves as the Senior Editor of International Journal of Thermophysics and Journal of Laser Applications, and associate editor of Heat Transfer Research.

Prof. Tassos G. Karayiannis

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Pool Boiling Review: Fundamentals and Heat Transfer Enhancement

Abstract:

Pool boiling and the concepts, possibilities and method of enhancing heat transfer during this process will be presented. The pool boiling process is one of the most effective heat transfer modes capable of transferring large amounts of heat with small temperature difference between the heated surface and the fluid. In addition, fundamental knowledge of pool boiling processes is the starting point of flow boiling research and applications. It is therefore no surprise that it has been, and still is, the subject of extensive research globally for quite some time. The current on-going research focuses on the understanding of boiling fundamentals, including bubble generation, growth and bubble dynamics. In this context, fluid-surface interaction is critical.

In this presentation we discuss the factors and parameters affecting the above, starting with the criteria for gas entrapment, nucleation site stability and the superheat required for heterogeneous nucleation. The models predicting the above are then critically described, classified into liquid-vapour interface stability and superheated boundary-layer based models. This first part includes bubble growth and departure models elucidating the effect of surface topology and wettability. In the second part of the presentation we focus on past proposed surface designs to enhance heat transfer rates. Two fluids, representing wetting and non-wetting fluids, used widely in industry and studied extensively, i.e. FC-72 and water, are used as examples, boiling on silicon and copper substrates. In this part of the presentation, we quantify and compare the different proposals bearing in mind the enhancement in the average heat transfer coefficient reported and the possible increase in the critical heat flux.

Biography:

Tassos Karayiannis studied at the City University London and the University of Western Ontario. He started his career as a researcher at Southampton University and later as a British Technology Group Researcher at City University. Subsequently he worked at London South Bank University and joined Brunel University London in 2005 where he is now Professor of Thermal Engineering and leads the Two-Phase Flow and Heat Transfer Research Group. Professor Karayiannis has carried out fundamental and applied research in a number of single- and two-phase heat transfer areas. He has been involved with two-phase flow and heat transfer for over 30 years. Initially he worked on the enhancement of pool boiling and condensation processes using high intensity electric fields (Electrohydrodynamic enhancement of Heat Transfer). In parallel, he carried out extensive experimental work in pool boiling heat transfer with plane and enhanced surfaces. Professor Karayiannis has also been very actively involved with research in flow boiling in small to micro tubes and micro-multi-channels. This work involves fundamental studies as well as research leading to the design of high heat flux integrated thermal management systems. His research has been funded by the UK Engineering

and Physical Sciences Research Council, Innovate UK and Industry. He has published more than 250 chapters in books, papers and industrial reports. He chairs the Committee of the International Conference Series on Micro and Nanoscale Flows now in its 7th edition and co-chairs the 6th World Congress on Momentum, Heat and Mass Transfer. He is a Fellow of the EI and the IMechE, Member of the Assembly for International Heat Transfer Conferences and the Chairman of the UK National Heat Transfer Committee.

Dr. Mohamed M. Mahmoud	
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Pool Boiling Review: Fundamentals and Heat Transfer Enhancement	
Biography:	
Mohamed M. Mahmoud graduated in 1998 from the Mechanical Engineering Department, Faculty of Engineering, Zagazig University, Egypt. He was employed as an assistant lecturer in the Environmental Engineering Department in the same university since 1999. He received his M.Sc. in 2004 in the field of biomass combustion from Zagazig University. He joined Prof. Karayiannis's research group, as a Ph.D. student, at Brunel University, London, UK, in 2007 and got his Ph.D. in 2011 in two-phase flow boiling heat transfer in small- to micro diameter tubes. He worked as a lecturer in the Environmental Engineering Department from 2011 to 2018. Currently, he is an associate professor in the Environmental Engineering Department, Zagazig University, Egypt. His research interests include pool boiling and flow boiling heat transfer in microsystems, solid waste/biomass thermal treatment for biofuel production, and thermal desalination systems.	

Prof. Xiulin Ruan

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Predictive Simulations of Modal Phonon and Photon Transport Properties

Abstract:

This talk will overview our recent developments of first principles and molecular dynamics methods for predicting modal phonon and photon transport properties, which are essential in many thermal management and sustainable energy applications [1]. By developing the quantum mechanical formalism for four-phonon scattering and mitigating the severe computational challenges, we have discovered four-phonon scattering as an unexpected intrinsic mechanism beyond three-phonon scattering to determine thermal conductivity of nearly all materials at high temperature, and 2D materials, low thermal conductivity materials, and certain high-thermal conductivity materials even at room temperature [2]. For complex crystals, the conventional phonon mean free path concept is insufficient, and we propose a dual-phonon transport theory to better describe their thermal transport [3]. We have further developed a modal non-equilibrium molecular dynamics method to uncover the universal modal phonon non-equilibrium phenomena in nanomaterials and across interfaces [4]. We will also show how the spectral optical and thermal radiative properties can be predicted using first principles and Monte Carlo simulations. The optical response for dielectrics is due to photon-electron interaction in the UV-VIS-NIR band and photon-phonon interaction in the MIR band. Here four-phonon scattering can have a leading role in determining infrared optical properties of dielectrics [5]. These predictions can explain the sub-ambient radiative cooling under direct sunlight we achieved in commercial-like particle-matrix paint for the first time [6]. We further show that machine learning can be used to dramatically accelerate the predictive design of thermal nanomaterials [7].

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Biography:

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