Jornada de

Escoamentos Multifásicos

JEM – 2023

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Núcleo Interdisciplinar de Dinâmica dos Fluidos (NIDF),
Universidade Federal do Rio de Janeiro(UFRJ).

The 7th Multiphase Flow Journey

The local organizing committee of JEM2023 welcomes the scientific and industry community to attend the 7th Multiphase Flow Journey, to be held atthe Technology Centre 2 of the Federal University of Rio de Janeiro on May 29-31, 2023.

The Multiphase Flow Journey is a biannual event, organized by the Brazilian Society of Mechanical Sciences and Engineering (ABCM). JEM2023 is a merger between the former School of Multiphase Flows (EEM) and the former Brazilian Meeting on Boiling, Condensation and Multiphase Flows (EBECEM).

The general expectation of the organizing committee is that after the recent hiatus in person meetings, the opportunity for the Brazilian national community in mechanics to meet in scientific events is to be well perceivedby people.

We look forward to welcome you in person in Rio de Janeiro!

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Program

May, 29th

Short Courses

08:00 - 09:00

Short Course
Su Jian (UFRJ)
Chair: Atila Freire

09:00 - 10:00

Short Course
Igor de Paula (PUC-Rio)
Chair: Atila Freire

10:00 - 10:30

Coffee-break

10:30 - 12:30

Short Course
Bayode Owolabi (UFRJ)
Chair: Tânia Klein

12:30 - 14:00

Lunch

14:00 - 16:00

Short Course
Luiz Fernando L. Rodrigues (UFRJ)
Chair: Gustavo Rabello

16:00 - 16:30

Coffee-break

16:30 - 18:30

Short Course
Gustavo Rabello (UFRJ)
Chair: Luiz Fernando Lopes Rodrigues

May, 30th

Short Courses, Technical Session & Invited Lecture

08:00 - 10:00

Short Course
Eduardo N. dos Santos (UTFPR)
Chair: Fabio Pereira dos Santos

10:00 - 10:30

Coffee-break

10:30 - 12:30

Technical Session
Droplets
Chair: Gherhardt Ribatski

12:30 - 14:00

Lunch

14:00 - 15:00

Invited Lecture
Carlo Massimo Casciola (Roma La Sapienza)
Chair: Juliana Loureiro

15:00 - 16:00

Technical Session
Phase Change,
Phase Flow Characterization
Chair: Panagiota Angeli

16:00 - 16:30

Coffee-break

16:30 - 17:30

Technical Session
Stratified Flow,
Annular Flow
Chair: Carlo Massimo Casciola

17:30 - 18:30

Technical Session
Slug Flow, Phase Flow Characterization
Chair: Oscar Hernandez

Technical Sessions Program

May, 30th

Droplets
Chair: Gherhardt Ribatski

10:30 - 10:42

Total Internal Reflection technique applied to analyze the contact area between droplets and heated substrates

A. C. Araya, L. P. Leitão, A. V. S. Oliveira

10:42 - 10:54

Characteristics of droplet stream generation for different diameters of the nozzle hole

J. M. M. Silva Filho, G. Castanet, M. Gradeck, A. V. S. Oliveira

10:54 - 11:06

Characteristics of multiple droplet stream generation using high-speed shadowgraphy

J. M. M. Silva Filho, G. Castanet, M.l Gradeck, A. V. S. Oliveira

11:06 - 11:18

Deformations of confined magnetic fluid droplets subjected to different magnetic field configurations

R. M. Oliveira

11:18 - 11:30

Using the Monte Carlo method to evaluate droplets interaction during spray cooling

C. E. B. M. Rocha, A. V. S. Oliveira

Technical Sessions Program

May, 30th

Phase Change, Phase Flow Characterization
Chair: Panagiota Angelie

15:00 - 15:12

Assessment of flow boiling prediction methods for pressure drop and heat transfer coefficient under high temperature and pressure conditions

D. B. Marchetto, G. Ribatski

15:12 - 15:24

Flow boiling of R1336mzz(Z) in a copper microgap with tapered manifold

D. C. Moreira, V. S. Do Nascimento Jr., S. G. Kandlikar, G. Ribatski

15:24 - 15:36

Nitrogen thin film evaporation applied to cryopreservation

H. Vidaletti, Á. S. da Silva; J. B. Copetti, J. D. de Oliveira, E. M. Cardoso, L. L. Manetti

15:36 - 15:48

Study of phase fraction distribution in horizontal gas/liquid flow via collimated gamma-ray densitometry

C.E. Alvarez-Pacheco, C.M. Ruiz-Diaz and O.M.H. Rodriguez

15:48 - 16:00

A Machine Learning Approach on Two-Phase Flow Characterization and Calculation Based on a Large Experimental Dataset

A. C. Faller, P. H. C. Paulo, S. C. Vieira, A. T. Fabro, M. S. Castro

Technical Sessions Program

May, 30th

Stratified Flow, Annular Flow
Chair: Carlo Massimo Casciola

16:30 - 16:42

Study on hydrodynamic stability of stratified liquid-liquid flow using optical techniques

P. J. Miranda-Lugo, Jorge E. Arrollo-Caballero and O. M. H. Rodriguez

16:42 - 16:54

Analysis of the wave characteristics for stratified-wavy flow during in-tube convective condensation

Neumeister, R. F., Kohlmann, A. L. G., Moreira, T. A. and Ribatski, G

16:54 - 17:06

Experimental investigation on upward-vertical adiabatic-inverted annular flow

E. Orati, O. M. H. Rodriguez

17:06 - 17:18

Liquid film behavior regarding pipe diameter on vertical downward annular flow

A. L. B. Santana, G. K. de Souza, E. N. dos Santos, M. J. da Silva, M. A. Marcelino Neto, R. E. M. Morales

17:18 - 17:30

Characterization of horizontal oil-water core-annular flow using particle image velocimetry (PIV) and planar laser induced fluorescence (PLIF) techniques

J. E. Arrollo-Caballero, P. J. Miranda-Lugo and O. M. H. Rodriguez

Program

Technical Sessions Program

May, 30th

Slug Flow, Phase Flow Characterization
Chair: Oscar Hernandez

17:30 - 17:42

Influence of the flow loop configuration on the slug flow characteristic parameters in vertical pipes
C. C. Rodrigues, P. A. D. Maldonado, E. N. dos Santos, M. A. Marcelino Neto, R. E. M. Morales

17:42 - 17:54

Slug flow of gas and shear thinning fluids in horizontal pipes
R. Baungartner, G.F.N. Gonçalves, J.B.R. Loureiro, A.P. Silva Freire

17:54 - 18:06

Experimental investigation of horizontal two-phase slug flow with high density gases
B. P. Naidek, M. V. R. Pereira, I. S. Veiga, E. M. Baggio, P. L. N. Machado, R. Fonseca Junior, M. A. Marcelino Neto, R. E. M. Morales

18:06 - 18:18

Characterization of two-phase flow pattern for qualitative flow induced vibration analysis in subsea Xmas tree
M. C., Oliveira, L. L. Palladino, S. T. Griffo

Program

May, 31th

Technical Session & Invited Lecture

08:00 - 09:00

Technical Session
Numerical Methods
Chair: Fabio Kanizawa

09:00 - 10:00

Technical Session
Centrifugal Flows, Gas Flow
Chair: Marcelo Castro

10:00 - 10:30

Coffee-break

10:30 - 12:30

Invited Lecture
Gherhardt Ribatski (USPScar)
Chair: Igor B de Paula

12:30 - 14:00

Lunch

14:00 - 15:00

Invited Lecture
Panagiota Angeli (University College)
Chair: Juliana Loureiro

15:00 - 16:00

Technical Session
Non-Newtonian Fluids,
Experimental Methods
Chair: Arthur Oliveira

16:00 - 16:30

Coffee-break

16:30 - 17:30

Technical Session
Particle Flow
Chair: Rigoberto Morales/
Juliana Loureiro

17:30 - 18:30

Invited Lecture
Fabio Kanizawa (Unicamp)
Chair: Gustavo dos Anjos

Technical Sessions Program

May, 31th

Numerical Methods
Chair: Fabio Kanizawa

08:00 - 08:12

Three Dimensional Two-Phase finite flement fimulation using a Front - Tracking Method
D. B. V. Santos and G. R. Anjos

08:12 - 08:24

Simplified lattice Boltzmann implementation of the Brinkman equation with applications in the viscous fingering instability
H. S. Tavares

08:24 - 08:36

Numerical Simulation of a Multiphase Flow inside a Diesel Particulate Filter
F. F. Ferreira, G. R. dos Anjos

08:36 - 08:48

Simulation of multiphase flow and analysis of droplet formation patterns in a microchannel
K. L. Pinto, V. L. P. Amorin, R. J. Lobosco, E. G. A. Costa, G. B. Lopes Junior

08:48 - 09:00

A semi-lagrangian finite element method for two-phase flows
G. R. dos Anjos, R. A. Vidal

Technical Sessions Program

May, 31th

Centrifugal Flows, Gas Flow
Chair: Marcelo Castro

09:00 - 09:12

Using electrical submersible pump mechanical vibrations and Fourierconvolution neural network to estimate the water cut in two-phase liquid-liquid flows
F. C. T. Carvalho, A. L. Serpa

09:12 - 09:24

Surging Parametrization for Gas-Liquid Centrifugal Pumps
L. E. M. Carneiro, G. S. O. Martins, C. M. P. Rosero, J. B. R. Loureiro, A. P. Silva Freire

09:24 - 09:36

A coupled PIV/PTV framework for the determination and assessment of interfacial momentum closure in dispersed two-phase rotating flows
W. D. P. Fonseca, R. F. L. Cerqueira, R. M. Perissinotto, W. Monte Verde, M. S. Castro and E. M. Franklin

09:36 - 09:48

Experimental methodology to simulate leaks in dense-gas/liquid pipe flow
C. M. Ruiz-Diaz, C. E. Alvarez-Pacheco, M. da Silva Carr, Oscar M. H. Rodriguez

09:48 - 10:00

Influence of the Slip parameter in pressure wave propagation in wet gas flow
J. E. C. Bolívar, O. M. H. Rodríguez

Technical Sessions Program

May, 31th

Non-Newtonian Fluids, Experimental Methods
Chair: Arthur Oliveira

15:00 - 15:12

Effect of drag reducing polymer on flow patterns of horizontal air-water flow

P. B. P. Panisset, I. B de Paula, L. F. A. Azevedo

15:12 - 15:24

Numerical study of capillary thinning dynamics with FENE-P model

R. A. Figueiredo, C. M. Oishi and A. M. Afonso

15:24 - 15:36

Measurement system for the airflow of an EA211 1.0 MPI Volkswagen engine

F. Frejat, F. Lisboa

15:36 - 15:48

Implementation of low cost espectrophotometer for MEG detection in water

R. Baldin, M. J. da Silva, E. N. dos Santos

15:48 - 16:00

Analysis of velocity fields during hydrogen production by electrolysis

J. D. de Oliveira, T. W. Leite, E. M. Cardoso, J. B. Copetti

Technical Sessions Program

May, 31th

Particle Flow, Liquid-liquid Flow
Chair: Rigoberto Morales/Juliana Loureiro

16:30 - 16:42

Effect of concentration on particle velocity in slurry flow in squared T-junctions

A. E. L. Silva, A. G. S. Araújo, D. A. Silva, C. P. Rosero and A. P. Silva Freire

16:42 - 16:54

Numerical simulation of particle erosion in slurry flow in squared T-junctions

E. R. David, D. A. Rodrigues and A. P. Silva Freire

16:54 - 17:06

Experimental Investigation of Particle-Laden Gas-Jets Impinging onInclined Surfaces

J. L. Araujo, C. M. P. Rosero, E. R. David, D. A. Rodrigues, A. P. Silva Freire

17:06 - 17:18

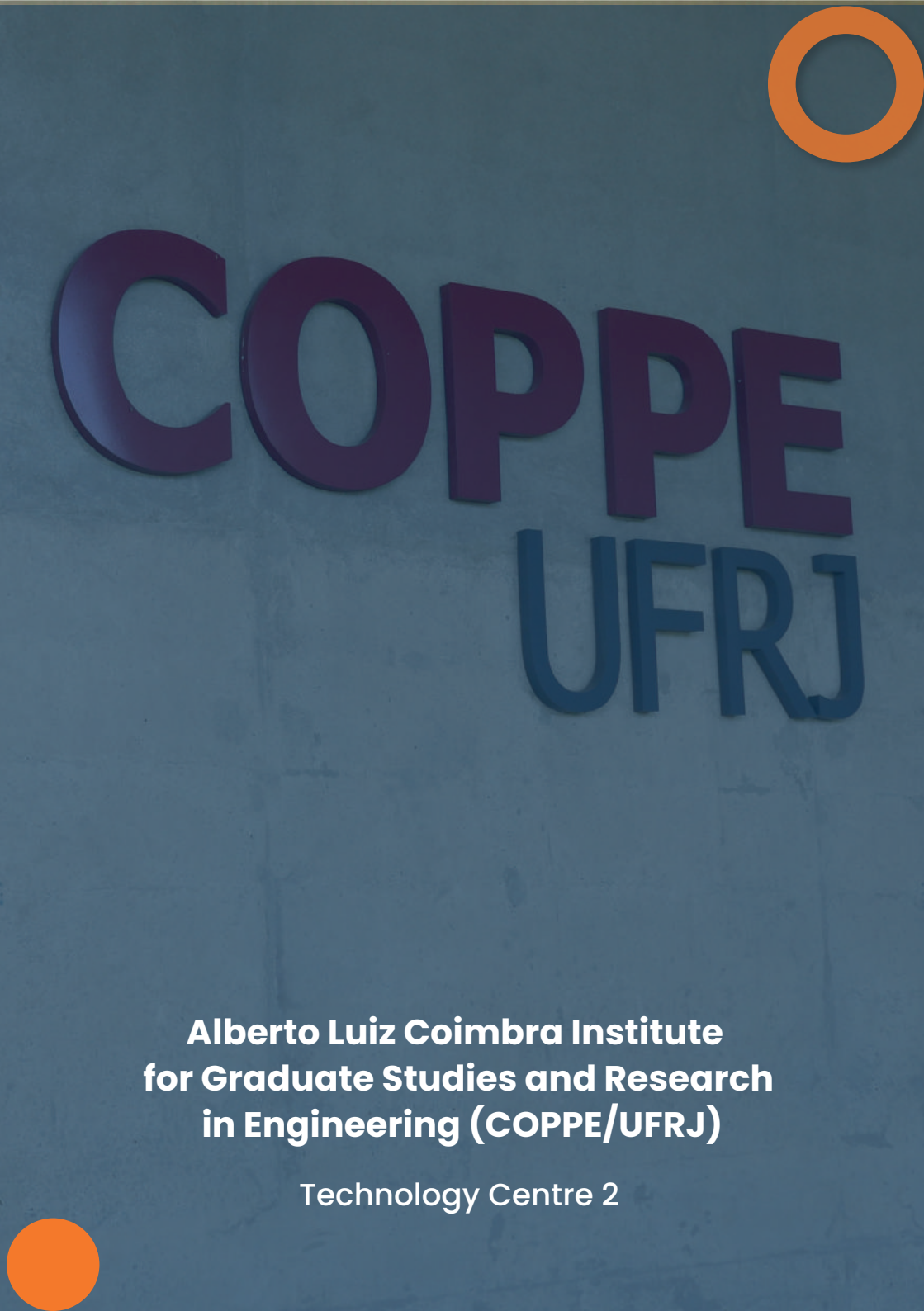
Experimental study of water flushed by a mixture of glycerol and water in a horizontal pipe

E. Freitas, M. Santos, R. Silva, M. Conte, E. Santos, M. Marcelino Neto, R. E. M. Morales

17:18 - 17:30

Particle dynamics in wall-bounded turbulence

B. Owolabi, R. Jackel, L. Moriconi, J. B. R. Loureiro



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Technology Centre 2


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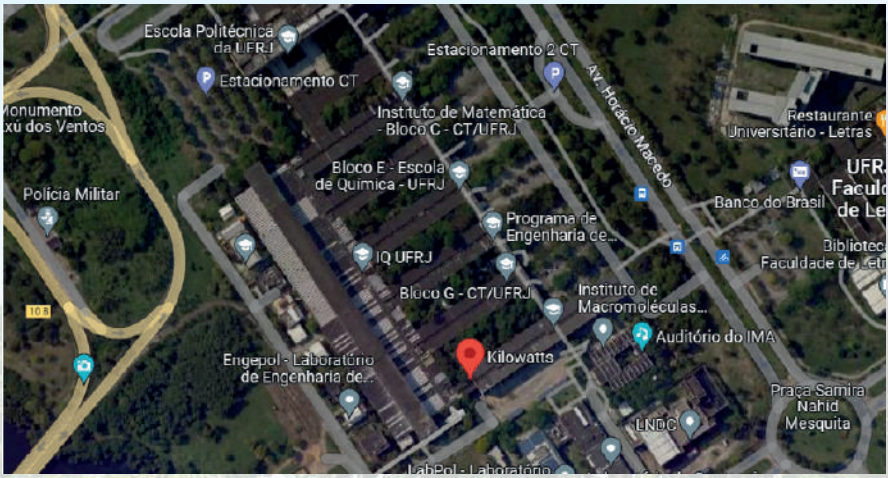
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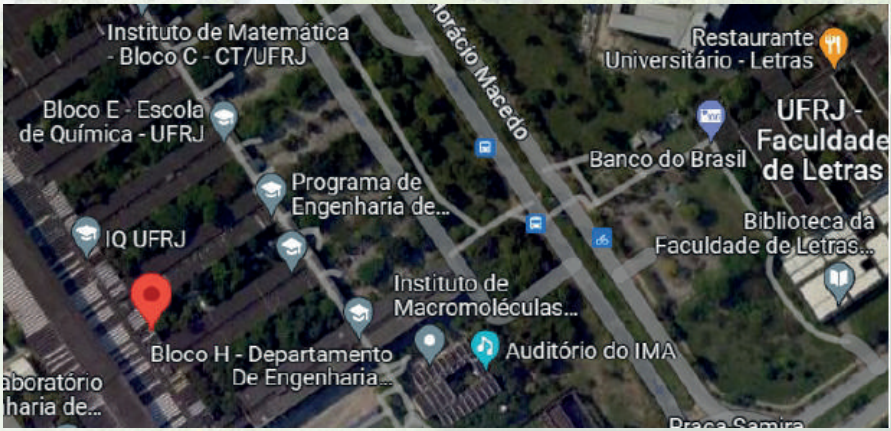
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Where are you gonna eat?!

The Techonology Centre has lots of options and you may choose whatever you want, depends on your hungry and your financial conditions. Here in University City, you can choose Notorio Sabor (1), where you have lots of options of Barbeque, Japanese food, pasta and the common self-sevice and you can find it at Technology Park on Rua Aloísio Teixeira, 278 University Town.

Another option, if you are thinking about going into a place and knowbetter about Technology Centre, you can find some restaurants from A block until H block. The one of the best of them is Kilowatts (2) andit is located between G block and H block. This one has lot optionsof homemade food in general.

And the last one is located on F block and has lots of options of self service and has a big space to be confortable enough. It calls Projectus (3) and you can choose whatever you want without any problems.

Short Courses, Technical Sessions and Invited Lecture (speakers)

From May 29th to 31th

Free short courses

Prof. Su Jian
Coppe/UFRJ

May, 29th - 8 to 9 am

Introduction to gas-liquid two-phase flow modeling

Professor Su Jian is a Full Professor in the Department of Nuclear Engineering at Coppe/UFRJ, he has a 1B level of productivity research intership from CNPq and the "Cientista do Nosso Estado" intership from Faperj. He obtained a Diploma in Thermal Physics Engineering from the University of Science and Technology of China (USTC), has a Master in Thermal Physics Engineering from the Chinese Academy of Sciences and a Doctoral degree in Mechanical Engineering from Coppe/UFRJ. He was a visitor Professor in universities out from Brazil such as Imperial College London, McMaster University, University of Hong Kong and Peking University. He managed research projects supported by CNPq, CAPES, Faperj and ANP, in addition to service provision projects for mining companies. His researches focus in areas like transport phenomena, multiphase flows, thermo-hydraulic for nuclear reactors, fluid-structure interection and radiologic safety evaluation of mining sediments.

Abstract

The classical concepts and main parameter more relevant parameters of flow patters for two-phase gas-liquid flows are presented, including formulations for the Homogeneous Equilibrium Model (HEM) and the Two Fluids Model (TFM) for 1D transient two-phase flow. Phenomenological models for horizontal stratified and slightly inclined flows, vertical annular flow, horizontal plug flow and vertical plug flow are also presented.

Prof. Igor de Paula
Dept. of Mechanical Engineering/PUC-Rio

May, 29th - 9 to 10 a.m

Optical techniques for measurements in gas-liquid flows

Igor B. de Paula holds a degree in Mechatronic Engineering from the Pontifical Catholic University of Minas Gerais (2002) and a doctorate (2007) in Aeronautical Engineering from USP-EESCP with a sandwich period at Stuttgart Universität, Germany. From 2007 to 2011, he worked asa researcher at the Laminar Wind Kannal (LWK) in Stuttgart. From 2011 to 2014, he worked as a post-doc in the Department of Mechanical Engineering at PUC-Rio. Since 2014 he has been an adjunct professor at the Mechanical Engineering Department of the Pontifical Catholic University of Rio de Janeiro (PUC-Rio). He teaches undergraduate and graduate students at PUC-Rio about experimental methods in fluid mechanics, hydrodynamic stability, signal processing and electronics for instrumentation. Prof. De Paula hasexperience in hydrodynamic stability applied to single and two-phase flows and developing optical flow measurement methods. His works have recently focused on the simultaneous measurement of flow fields of two-phase flows in pipes using Particle Image Velocimetry, Shadowgraphy and controlled disturbances.

Abstract

This short course reviews the most used techniques for measurements in gas-liquid flows. Basic concepts of flow visualization and image processing are discussed in the context of two-phase flow measurements. Finally, some experimental results are shown to illustrate the application of the methods.

Free short courses

Bayode Owolabi
Reseacher/UFRJ

May, 29th - 10:30 am to 12:30 pm

Experimental methods for multiphase flow studies: state-of-the-art and current challenges

Bayode Owolabi is a postdoctoral researcher at the Interdisciplinary Centre for Fluid Dynamics (NIDF), UFRJ. He completed a bachelor's degree in Mechanical Engineering at the Federal University of Technology Akure Nigeria in 2010, after which he was awarded a Commonwealth scholarship for a master´s degree in Energy Generation at the University of Liverpool. In 2015, Bayode was enrolled on the dual PhD programme between the University of Liverpool and National Tsing Hua University Taiwan, and successfully defended his thesis in December 2018. Since then he has worked as a researcher at the University of Alberta in Canada and a lecturer at the Federal University of Technology Akure, before coming to Brazil. His research interests include wall-bounded turbulent flows, transition to turbulence, polymer drag reduction, rheology and particle-laden flows.

Abstract

Multiphase flows are fascinating, ubiquitous and equally challenging. A fundamental physical understanding of such flows is therefore very important for making predictions about various processes. Experiments play a key role in this regard and are instrumental to the formulation of models/correlations which can be used in numerical simulations. In this short course, the currently available experimental tools will be introduced and their guiding principles discussed. A list of challenges currently being faced in the implementation of these methods will also be pointed out and pathways for future developments will be discussed.

Prof. Luiz Fernando Lopes Chemical Engineering School/UFRJ

May, 29th - 2 to 4 pm

Disperse multiphase flow modelling approaches

Dr. Luiz Fernando Lopes Rodrigues Silva holds a bachelor's and postgraduate degree in Chemical Engineering from UFRJ, completing his doctorate in 2008. His thesis entitled "Development of methodologies to simulate polydisperse flows using open source code" was the first to use the package CFD OpenFOAM in Brazil. Luiz Fernando is an associate professor at Escola de Química/UFRJ and keeps teaching and research activities in several transport phenomena and computational fluid dynamics fields, such as multiphase processes, heat and mass transport and industrial separation systems.

Abstract

A detailed analysis of regime flow maps reveals the complexity of multiphase flows. Indeed, choosing a proper modelling approach for multiphase flow systems is directly linked to the flow regime. This course will analyse different modelling approaches in dispersed flows according to the map flow regime. We will discuss the Lagrangian and Eulerian approaches and their equations, forces and aspects of particleinteractions. In conclusion, the participants will improve their ability to interpret the physical situation of a zz given problem and be able to decide on the best model options for multiphase flow in fluid dynamic simulation programs.

Free short courses

Prof. Gustavo R. dos Anjos
Chemical Engineering School/UFRJ

May, 29th - 4:30 to 6:30 pm

Modeling of deformable interface in two-phase systems

Dr. Gustavo Rabello dos Anjos was born in Rio de Janeiro in 1980. My research field is the numerical simulation on single- and two-phase flows. During my doctoral studies, I'd been working on the discretization of fluid motion equations and the modeling of interfacial forces through the Finite Element Method. The developed in-house numerical code has been designed by modern and flexible object-oriented languages: (C++) and (Python) which allowed easy maintenance and further development. My Ph.D. thesis was selected to be among the 5-10% of best thesis written at EPFL in 2012. From Aug. 2012 to Aug. 2013 I worked as a Post-Doc Associated in the Nuclear Science & Engineering (NSE) at the Massachusetts Institute of Technology (MIT) in Cambridge/ Boston. The goal of the Post-Doc position was to benchmark the boiling/condensation experimental database using a commercial front-capturing code available in the MIT group. In Sep. 2013, I finally returned to Brazil as Post-Doc assistant sponsored by the Brazilian agency CAPES/Science Without Borders – Young Talent Fellowship. In 2014 I became a young Mechanical Engineering professor at the State University of Rio de Janeiro (UERJ). In 2019 I've started a professorship position at the Federal University of Rio de Janeiro (UFRJ). I'm a member of the graduate school of Mechanical Engineering at (COPPE), Young Researcher of the State of Rio de Janeiro (FAPERJ), and currently awarded Royal Society-Newton Advanced Fellowship.

Abstract

In this short course, an overview of classical to modern methods used for modeling interface deformation in two-phase systems will be presented. Methods such as Volume-of-Fluid (VOF), Level-Set (LS), and moving mesh type (ALE-FEM) will be presented, as well as a discussion of their differences. Bubble dynamic animations will be presented.

Prof. Eduardo N. dos Santos
Graduate Program in Energy Systems/UTFP

May, 30th - 8 to 10 am

Sensors and Instrumentation for multiphase flow monitoring

Eduardo Nunes dos Santos is Professor of the electronics department (DAELN/UTFPR) and in the Graduate Program in Energy Systems (PPGSE/UTFPR). Computer engineer with a master's and doctorate in Electrical Engineering with expertise in Automation and Systems Engineering. Worked as a researcher at the Helmoltz-Zentrum Dresden-Rossendorf, developing sensing techniques for multiphase flow. Co-founder of a technoloy-based startup (Specrux) and Multiphase Flow Research Center (NUEM/UTFPR) member, which has more than ten years of experience in R&D projects with companies in the oil and gas sector, working mainly in the following areas: Embedded systems, Instrumentation, and real-time sensors for monitoring industrial processes.

Abstrac

Developing techniques for multiphase flow investigation has been a significant challenge due to the complex nature of the phenomena. However, multiphase flow meters have become increasingly accurate and reliable with technological advances, including more sophisticated sensor technologies and data processing techniques. With the recent advances in the Industrial Internet of Things, it is possible to perform real-time monitoring and control of flow conditions. In a distributed context, devices can collect data from

multiple sensors in different parts of the flow system and transmit this data to a hybrid system, combining physics-based and data-driven models. This approach can improve the accuracy of multiphase flow measurements and rapid detection of undesirable phenomena such as hydrates formation, and also prevent equipment failures and ensure safe operation.

Invited Lecture

May, 30th - 2 to 3 pm

Prof. Carlo M. Casciola
Sapienza University of Rome

The nucleation process and its coupling to the macroscale

Carlo Massimo Casciola is presently the Dean of the Faculty of Civil and Industrial Engineering at La Sapienza University of Rome where he leads a research group based at the Mechanical and Aerospace Department working on the dynamics of complex flows and the coupling of macroscopic flows with a microstructure. He has given contributions to turbulence, particulate, polymers-laden, and multiphase flows, micro/nanofluidics through molecular dynamics simulations and free-energy methods, and mesoscale methods (phase field methods and fluctuating hydrodynamics). He received the prestigious ERC Advanced Grant, BIC – Following Bubbles from Inception to Collapse, and recently developed a novel microfluidic chip to study cavitation-enhanced blood vessel permeability thanks to the ERC Proof of Concept grant INVICTUS, IN VItro Cavitation Through UltraSound.

Abstract: Bubble nucleation is a ubiquitous phenomenon whose prediction proved a formidable task, particularly in the case of water. Here a self-contained model is discussed which is shown able to accurately reproduce data for bulk water over the most extended range of temperatures for which accurate experiments are available [1]. The computations are based on a Ginzburg-Landau model which, as only inputs, requires a reliable equation of state for the bulk free energy and the interfacial tension of the water-vapor system. Rare event techniques borrowed from statistical mechanics allow the determination of the free-energy barrier and the nucleation rate. By consistently including thermal fluctuations [2] in the spirit of Fluctuating Hydrodynamics, the approach is extended to dynamic conditions in presence of solid walls of different wettability [4] to allow coupling with fluid motion [4]. The talk will focus on the wall wettability in compliance with the fluctuation-dissipation balance, a crucial point in the context of the fluctuating hydrodynamics theory. Depending on time availability, new, still unpublished results concerning the coupling of nucleation and fluid flow, the effect of micro-confinement, and time-changing thermodynamic conditions will also be addressed.

References

[1] F. Magaletti, M. Gallo, C.M. Casciola, Water cavitation from ambient to high temperatures, Scientific Reports 2021, 11 1.
[2] M. Gallo, F. Magaletti, C.M. Casciola, Thermally activated vapor bubble nucleation: the Landau Lifshitz/Van der Waals approach, Phys. Rev. Fluids. 2018, 3, 053604.
[3] M. Gallo, F. Magaletti, C.M. Casciola, Heterogeneous bubble nucleation dynamics, Journal of Fluid Mechanics 2021, 906 10.
[4] M. Gallo, F. Magaletti, D. Cocco, C.M. Casciola, Nucleation and growth dynamics of vapor bubbles, Journal of Fluid Mechanics 2020, 883.

May, 31th - 10:30 to 11:30 am

Prof. Gherhardt Ribatski
USPScar

Flow boiling of water and R1336mzz(Z) in asymmetric Dual-V microchannels with tapered manifold

Dr. Gherhardt Ribatski is Full Professor of Multiphase Flow and Heat Transfer at the São Carlos School of Engineering, University of São Paulo (USP), Brazil. He received his BS, MSc. and Doctoral Degrees in Mechanical Engineering from the University of São Paulo. He held postdoctoral positions at the University of Illinois at Urbana–Champaign, Swiss Federal Institute of Technology in Lausanne (EPFL) and Universidade da Coruña. His research interests cover nanofluids, pool boiling, falling-film evaporation and condensation, two-phase flow, flow induced vibration, flow boiling and condensation for external and internal flows, heat transfer enhancement, heat exchangers, phase-change in microchannels, IR thermography and solar energy. Prof. Ribatski is member of the Congress Committee of International Union of Theoretical and Applied Mechanics (IUTAM) and Brazilian Delegate to the Assembly for International Heat Transfer Conferences. He is member of Assembly of World Conferences on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics, Virtual Institute of Two-Phase Flow and Heat Transfer, Scientific Council of the International Centre for Heat and Mass Transfer (ICHMT). He was Director Secretary (2016-2017) and President of the Brazilian Society of Mechanical Sciences and Engineering (2018-2021). He has served as coordinator of the CAPES (Coordination for the Improvement of Higher Education Personnel- Brazil) committee for evaluation of graduate programs in the areas of Mechanical, Mechatronics, Naval and Ocean, Aeronautical, Industrial and Petroleum Engineering.

He is member of the area panel of Engineering of FAPESP (São Paulo Research Foundation – Brazil) and was Coordinator of the Graduate Program of Mechanical Engineering at São Carlos School of Engineering (EESC) of University of São Paulo (USP) from 2014 to 2019. He is subject (heat transfer) editor of Applied Thermal Engineering, editor of Experimental Thermal and Fluid Science and member of the Advisory Board of International Journal of Multiphase Flow. He has presented 13 keynote lectures and taken part in the scientific committee of several International Conferences. Dr. Ribatski has over 110 refereed journal publications, 6 book chapters, 1 book and over 120 refereed papers in conferences.

Abstract

Among many existing techniques used to dissipate high heat fluxes, heat sinks based on flow boiling in microchannels enables the dissipation of high heat fluxes with impressive values of heat transfer coefficient inducing negligible temperature gradients along the devices. Over the last decades, many efforts have been made to develop these heat sinks, revealing mechanisms that can be altered to enhance flow boiling heat transfer and contributing to the knowledge on this subject as a way to reveal guidelines that could help in designing arrays of microchannels that are optimized to the desired application, given material, temperature and pressure constraints, for example. In a recent investigation in collaboration with the Thermal Analysis, Microfluidics and Fuel Cells Laboratory (TAμFL) from RIT, led by Prof. Satish Kandlikar, we have presented new heat sinks composed of a bottom surface milled with asymmetric Dual-V microchannels combined with a tapered microgap. The design of this surface follows a mechanistic approach to direct the generated bubbles and organize the flow in preferential liquid and vapor paths, reducing instabilities and improving heat transfer with low values of pressure drop, which was observed in an extensive experimental campaign. Experiments with water enabled the dissipation of 5 MW/m2 and revealed the occurrence of boiling inversion for the first time in flow boiling, while the dissipation of almost 1 MW/m2 was reached in experiments with the refrigerant R1336mzz(Z).

Overall, the total pressure drop measured during the experiments was lower than 10 kPa. The obtained results show that novel microstructured surfaces can be rationale engineered in order to benefit from the active physical mechanism during flow boiling.

May, 31th - 2 to 3 pm

Profa. Panagiota Angeli
University College

Drop coalescence and the effects of surfactants

Prof Panagiota Angeli, FIChemE, is a Professor in the Department of Chemical Engineering at UCL, Deputy Head ED&I, and leads the ThAMeS Multiphase group. She obtained a Diploma in Chemical Engineering from the National Technical University of Athens and a PhD on Multiphase Flows at Imperial College London. She specializes on complex multiphase flows particularly those involving two liquid phases. Her research aims to link small scale interactions and interfacial phenomena to the macroscopic behaviour of the complex flows and to the development of predictive models. She has been investigating the effects of surfactants, particles and non-Newtonian rheologies on microchannel drop formation and on coalescence, as well as their applications to the analysis and intensification of metal separations, and to the manufacturing of complex formulations. The experimental investigations have been enabled by original and advanced sensing and measurement techniques, such as micro-and high speed Particle Image Velocimetry (PIV) and ultrasound. Prof Angeli's work has been supported by substantial UK Research Council and European Union grants and by industry. She has been awarded a RAEng/Leverhulme Trust Fellowship, and has participated and chaired UK EPSRC and international (Norway, Sweden, Ireland, Belgium) research funding review panels. She co-chairs the Multiphase Flows Special Interest Group of the EPSRC funded UK Fluids Network and has publishedabout 200 journal papers.

Abstract

Dispersions of two immiscible liquids find numerous applications in the energy and manufacturing sectors, including transportation of multiphase mixtures, enhanced oil recovery, pharmaceutical and healthcare formulations, food and agrochemicals. One of the main phenomena that define the droplet size in the dispersion is coalescence. Surfactants are often naturally present in the fluids or added during processing to vary the interfacial properties, control the drop size, stabilise the dispersions and influence the final product rheology. This talk will discuss coalescence studies of drops with liquid-liquid interfaces and the effects of surfactants. Experiments have considered two-and three-dimensional configurations for a wide range of liquid properties which resulted in both full and partial drop coalescence. Surfactants were found to reduce the partial coalescence region in the Ohnesorge-Bond map. Velocity fields during coalescence were studied with high-speed particle image velocimetry while the distribution of fluorescent surfactants at the coalescing interfaces was investigated with planar laser-induced fluorescence. A novel configuration has been developed to investigate the delayed coalescence of drops with moving interfaces, which is very relevant to continuous separators and to flow processing of dispersions.

May, 31th - 5:30 to 6:30 pm

Prof. Fabio Kanizawa
Unicamp

Spatial filter velocimetry – application for external flow across tube bundles

Fabio Toshio Kanizawa is currently an assistant professor at the State University of Campinas. Was granted the titles of BSc., MSc., and DSc. at the University of São Paulo, and performed a post-doctoral internship at Kobe University. Has published a book about two-phase flow and heat transfer in microscale channels, as well as several papers. Is interested in the topic of heat transfer during phase change, multiphase flow, thermal systems, and instrumentation for fluid and thermal systems, among others.

Abstract

This presentation addresses the Spatial Filter Velocimetry technique, which is an interesting alternative for flow velocity measurement. This method is based on the capture of a sequence of images of tracing particles, followed by a post-processing step. The post-processing step corresponds to the application of a digital filter, aiming to mimic fringe lines, and frequency analysis, and can be considered as a computer-based LDV. The method was used for the determination of the flow velocity field during single and two-phase flow across tube bundles using an adaptive meshing scheme. Based on the obtained velocity profile, it was possible to obtain high-resolution results close to the rods' surfaces, and to evaluate the Reynolds stress tensor components.

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