工学系WINGS産学協創教育推進基金

第431回GMSI公開セミナー／第176回WINGSセミナー

Recent Progress in Computing Complex Multiphase Flows

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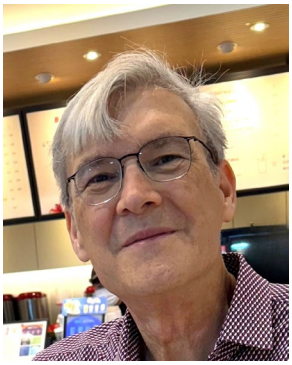
Date: Thursday, October 10, 2024 16:30-17:30
Venue: Faculty of Engineering Bldg. 2, Room 232

Abstract:

The ability to predict the behavior of multiphase flows accurately, reliably, and efficiently addresses a vast array of challenges of global societal, medical, economic and scientific importance. Flows with multiple interacting phases give rise to interfacial phenomena whose deep and quantitative understanding is crucial for solving global challenges such as ocean-atmosphere greenhouse gas exchange, capture or storage of CO2, aerosol and cloud physics, water desalination and treatment. Such real and varied systems are necessarily quite complex, often turbulent, multiphase flows where mass (species), momentum and energy are exchanged across, usually contaminated surfactant-laden, interfaces between bulk phases which may themselves exhibit non-Newtonian rheology or even change phase. In engineering applications, such flows are central to nearly every processing and manufacturing technology such as microfluidics lab-on-a-chip for biomedicine, mixing, scrubbing, refining and distillation in chemical processes, atomization, jets and sprays in combustion, surfactant enhanced flows in oil-water petroleum processes, dispersants in oil spill mitigation, bubble formation in glass production, alloy solidification in materials processing and steam generation for fossil and nuclear energy.

The crucial commonality among all of these complex multiphase systems is the interface, whether it be between liquid, gas or solid. In this talk I will present an overview of our numerical approach to simulate such interfacial flows. I will highlight some of our group's recent work in a variety of regimes (drop splash, bubble bursting, fluid mixing) involving surfactant-laden flows and fluid-structure interaction with diverse applications such as kidney stone removal, microfluidics, ocean microplastics and Faraday waves.



Dr. Damir Juric

Brief Professional Biography of Dr. Damir Juric

Damir Juric is a Senior Research Scientist with appointments at Cambridge University (DAMTP) and Centre National de la Recherche Scientifique (CNRS, France). He received his doctorate from the University of Michigan in 1996 and subsequently worked in the Los Alamos National Laboratory's Theoretical Fluid Dynamics Group, at the Georgia Institute of Technology and Worcester Polytechnic Institute. Through worldwide collaborations Dr. Juric applies his research in computational physics and fluid dynamics of multiphase flows to global societal challenges in health, environment and energy.

主催: 東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション（GMSI）
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