COMBUSTION WEBINAR

Multiscale complexities of turbulent reacting flows: from faster hydrogen-air flames to superspreading events

Speaker: Prof. Swetaprovo Chaudhuri, University of Toronto Institute for Aerospace Studies

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Biography: Prof. Swetaprovo Chaudhuri is an Associate Professor at the University of Toronto Institute for Aerospace Studies, and a Visiting Faculty Fellow at the Department of Aerospace Engineering, IIT-Madras. He works in turbulent reacting and multiphase flows and has contributed to the understanding of turbulent flame stabilization, propagation, and structure using experiments, theory, and computations. He earned his Ph.D. from the University of Connecticut. Subsequently, he worked at Princeton University as a research staff and then as a faculty member at the Indian Institute of Science. Prof. Chaudhuri has authored/co-authored over hundred articles in journals, conferences, and books and has been honored by several organizations. He is an elected Associate Fellow of the American Institute of Aeronautics and Astronautics and is a member of its Propellants and Combustion technical committee. He also served as a member of the Covid-19 Modeling Consensus Table, an advisory body for the Government of Ontario.

Abstract: Turbulent combustion research can enable the pursuit of timeless questions, often in ostensibly different disciplines. For example: how turbulence-flame interaction can lead to faster flame propagation at local and global levels, or what leads to superspreading events in the context of the recent pandemic? Can we make robust, mathematical models to describe them? Timely answers to these questions are pivotal to the systematic development of hydrogen-based gas turbines or for the development of strategies to stop the next pandemic, respectively. In this talk, we will discuss the recent advances made in understanding and modeling local propagation and structure of premixed hydrogen-air flames in turbulence using Flame Particle Tracking techniques applied to Direct Numerical Simulations with detailed chemistry. These developments could be used to answer questions on global propagation rates characterized by turbulent flame speed using a recently developed theoretical framework. Finally, it will be shown that experience with turbulent reacting flows can be useful in mathematically describing multiscale phenomena like superspreading events – the established driver of Covid-19 disease dynamics.

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