OpenFOAM & Combustion Simulation

Radiation Modeling in Combustion Applications

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Host: Prof. Bosen Wang (Beihang University)

Register: https://nus-sg.zoom.us/webinar/register/WN_aRmoxlXkTICR6AqAvIb7IA

Abstract

Radiative heat transfer in combustion systems has received relatively little attention to date. Modeling of radiation in combustion systems is either neglected or grossly simplified. Recently, it starts to generate increasing interest given the current trends of engine designs for both internal combustion engines and aeronautical engines. Meanwhile, the need to properly model radiative heat transfer in fire-related scenarios is another driver of interest. Radiation inside combustion systems is a complex process involving the interactions between spectral gases, soot, droplets, turbulence and the enclosure geometry. Gasses and soot/wall have distinct emission and absorption characteristics, and particles such as spray droplets or water mists have strong scattering effects that might alter the distribution of the heat flux. The turbulent fluctuations in temperature and composition add further complexity to the problem by affecting the production and destruction of soot in a significant manner. The complex geometries encountered in conventional engines or enclosure fires create difficulties in measuring and modeling the heat transfer processes, which hinders the understanding of the physical processes. In this presentation, recent progress in developing high-fidelity radiation models for combustion applications within the speaker's group will be summarized. Examples of coupled simulations within the framework of OpenFOAM will be highlighted. Finally, model and solver selection for balancing computational cost and accuracy will be discussed.

About the Speaker

Dr. Xinyu Zhao is an Associate Professor and Director of the Computational Thermal Fluids Laboratory at University of Connecticut (http://xyzrg.engr.uconn.edu/). She is also the Director of Graduate Studies of School of Engineering at UConn and serves on the Eastern States Section of the Combustion Institute Board. Prior to joining UConn in 2015, she was a postdoctoral research fellow in Combustion Energy Frontier Research Center at Princeton (2014), co-sponsored by Sandia National Laboratory and Pennsylvania State University. She received her Bachelor's and Master's degrees in Thermal Engineering from Tsinghua University (2006 and 2008), and she received her Ph. D. in Mechanical Engineering from Pennsylvania State University (2014). Dr. Zhao's research interests are in the area of computational fluid dynamics, with a focus on high-fidelity simulations of reactive flows, radiative heat transfer, multi-phase combustion, the interplay of computation and experiments, and high-performance computing. She is a recipient of the AFOSR Young Investigator Award, the ACS PRF DNI award, NSF Career Award, and the Irvin Glassman Young Investigator Award.