

# Boulder Fluid and Thermal Sciences Seminar Series



Friday, March 16, 2018

2:00pm-3:00pm (refreshments at 1:45pm)

Clark Conference Room (ECAD 150), Engineering Center

University of Colorado, Boulder

## Detailed Modeling of Turbulent Fire Systems

*Xinyu Zhao, University of Connecticut*

Fire spans a large range of temporal and spatial scales, and involves multiphysical processes. Turbulence, homogeneous and heterogeneous chemical reactions, radiative heat transfer, and multiphase transport can simultaneously be significant in fire. To maintain reasonable computational cost, reduced-order models are often required to describe these processes in order to predict the dynamics of fire. Such reduced-order models often require extension or re-formulation whenever a new aspect of the underlying physics demands attention. In this talk, our recent effort on developing high-fidelity models for the fire environment is introduced. In particular, we are concerned with the scenario of fire extinguishment where turbulence-droplet-radiation interactions are important. The solutions obtained from the high-fidelity models are leveraged to provide benchmark data for the reduced-order models or to provide closure information. Two modeling aspects are detailed in this talk, including the development of a comprehensive Monte Carlo ray tracing solver that accounts for radiative interactions between gas, soot, wall and water droplets, as well as the development of a reduced-order soot model. Finally, the numerical aspects of the underlying flow solver (OpenFOAM), as well as the effort in enabling large-scale direct numerical simulation on the multicore computing architectures (i.e., Intel Knights Landing) are briefly discussed.

**Biography:** Dr. Xinyu Zhao is an assistant professor at University of Connecticut. She joined the Mechanical Engineering Department in Spring 2015, and prior to that, 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 Ph. D. degree in Mechanical Engineering from Penn State (2014), and she received her Bachelor's and Master's degrees in Thermal Engineering from Tsinghua University (2006 and 2008). Dr. Zhao is actively working on detailed radiation modeling, turbulent combustion modelling, as well as direct numerical simulations. She is a recipient of the AFOSR Young Investigator Award, the ACS PRF DNI award, and NSF CRII Award. Her group is actively collaborating with industrial partners such as FM Global and United Technologies on multiphase multiphysical combustion simulations.

