ME Seminar

Inference of forcing functions in particle systems

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ABSTRACT

Particle- and droplet-laden flows occur in many anthropogenic and natural environments. For example, the mixing of liquid fuel spray and/or solid fuel particles with turbulent gas flows determines the efficiency of many propulsion and energy systems. Environmental pollution is affected by the dispersion of aerosol particles in environmental carrier air flow. The number of particles in a process-scale environment is too large to simulate with first-principle based methods on current-day computational resources. Macro-scale models and simulation techniques are necessary to simulate such problems. The Eulerian–Lagrangian (EL) method combined with point particle modeling provides a natural framework. It uses Eulerian continuum models to describe the dynamics of the ambient flow and tracks individual volume-less particles along their Lagrangian paths. The point particle model reduction comes with a significant reduction of fidelity that in turn is frequently used as a poor excuse to use low fidelity model approximation methods. In a pursuit to enhance the fidelity of point particle-based approaches, I have developed data-driven techniques that infer forcing functions from experimental data using techniques of inference. In this talk, I will review these models, numerical and optimization methods and developments.

ABOUT THE SPEAKER

Professor Gustaaf Jacobs received a M.Sc. in Aerospace Engineering from Delft University of Technology in 1998, where after graduation, he was appointed to Research Associate. He received a Ph.D. in Mechanical Engineering from the University of Illinois at Chicago. Following graduation in August of 2003, he was appointed Visiting Assistant Professor in the Division of Applied Mathematics at Brown University. He later combined this position with a Postdoctoral Fellowship at the Department of Mechanical Engineering at the Massachusetts Institute of Technology. As of August 2006, he was appointed Assistant Professor of Aerospace Engineering at San Diego State University and was promoted to Associate Professor in August of 2010. In 2013, he was promoted to Full Professor. He graduated with a Honor Propaedeuse from Delft University of Technology. In 2002 he was awarded a University Fellowship at the University of Illinois. He received an AFOSR Young Investigator Award in 2009 and became an Associate Fellow of the American Institute of Aeronautics and Astronautics in 2013.

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