MAE Seminar

Atomization of Turbulent Liquid Jets

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Abstract

The atomization of liquids in turbulent environments is a key process in many natural phenomena and technical applications. It is typically the first in a sequence of steps that ultimately results in energy conversion in the form of combustion. It can thus strongly impact combustion stability, efficiency, and pollutant production. Commonly, atomization can be divided into two consecutive steps: the initial primary atomization of the liquid into large and small scale structures, followed by the secondary atomization of these structures into ever smaller drops. While a number of established models exist for the latter process, the details of the turbulent primary atomization process are as of this day not well understood. Detailed numerical simulations can help study the fundamental mechanisms of the initial breakup in regions, where experimental access and analysis is virtually impossible. However, simulating atomization accurately is a tremendous numerical challenge since time and length scales vary over several orders of magnitude, the phase interface is a material discontinuity, and surface tension forces are singular. In this talk, these challenges and the resulting requirements for numerical methods will be discussed. A recently proposed level set based method capable of simulating primary atomization will be presented and results of detailed numerical simulations of the primary atomization of a Diesel jet and a liquid jet in crossflow will be discussed.

Biosketch

Marcus Herrmann received his Diploma and Ph.D. in Mechanical Engineering from the University of Technology (RWTH) Aachen, Germany. He was a visiting scientist at the University of Technology Eindhoven, The Netherlands and postdoctoral fellow and research associate at the Center for Turbulence Research (CTR) at Stanford University. He joined the faculty of Arizona State University in 2007. His primary research areas are numerical methods for tracking interfaces, the simulation and modeling of turbulent multiphase flows during atomization processes, and turbulent premixed and partially premixed combustion.

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Refreshments will be provided

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