



College of Engineering
Department of
Mechanical & Industrial Engineering

Joint Sidney E. Fuchs / EPIC Seminar

3:00-3:50pm, Friday, October 23rd, 2015
Frank H. Walk Room (ELAB Building)



Enabling Computational Modeling of Novel Fuel Atomization Processes

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Liquid-gas flows are ubiquitous in environmental and engineering applications. One category of flow of great importance in energy conversion devices is the formation of a liquid spray, a process called atomization. Due to their nonlinear and multiscale nature, such turbulent multi-phase flows present a significant modeling challenge, especially when novel control strategies such as electro-hydrodynamics are considered. For example, instabilities that develop at the liquid-gas interface are controlled by thin boundary layers, yet such instabilities impact the large-scale flow dynamics and influence atomization. In addition, flow variables exhibit discontinuities across the phase interface, complex microscale dynamics arise due to surface tension, and the interface develops highly complex corrugations.

With the advent of more powerful computing resources, simulating such flows from first principles is becoming viable. As with single-phase flows, numerical methods need to be carefully designed to guarantee convergence under grid refinement, primary conservation of key quantities such as mass and momentum, and excellent parallel performance. We will discuss how such properties can be obtained in the context of various liquid-gas turbulent flows, including a liquid jet in cross-flow and electro-hydrodynamic fuel atomization.

* Dr. Olivier Desjardins is currently an Associate Professor in the Sibley School of Mechanical and Aerospace Engineering at Cornell University. He received a Master of Science in Aeronautics and Astronautics from ENSAE (Supaero) in Toulouse, France, and a Master of Science in Mechanical Engineering from Stanford University in 2004. He graduated from Stanford University in June 2008 with a Ph.D. in Mechanical Engineering. His doctoral research on numerical methods for accurate simulations of reactive multiphase turbulent flows was performed at the Center for Turbulence Research under the guidance of Prof. Heinz Pitsch.