Mechanical Engineering Department Seminar

3:35pm February 5, 2014
1130 Mechanical Engineering

Advancing the Sustainability of Spray Combustion Applications: An Integrated Experimental-Computational Approach

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The combustion of liquid petroleum fuels has provided a robust, inexpensive, and dense energy source for propulsion applications for the last century, but declining petroleum resources and an increasing awareness of the environmental impacts of petroleum combustion are motivating substantial changes to the design and operation of liquid-fueled propulsion engines. Indeed, national goals for CO2 emission reductions and improved vehicle fuel economy will require, at a minimum, a doubling in the fuel economy of ground transportation vehicles over the next twenty years. Our research activities are centered on hastening advancements in the sustainability of liquid-fueled combustion applications by combining novel computational models and advanced optical measurements to study spray combustion physics, with a current focus on internal combustion engine applications. Our current experimental projects aim to study the atomization physics of high-pressure fuel sprays and to study the role of evolving fuel sources and fuel injector technology on spray combustion processes. Supporting computational projects in our group are using these experimental data to develop improved fuel-flexible injection, spray, and combustion models to advance the predictive capabilities of engine models. We envision leveraging these models in massive multi-variable optimization schemes to rapidly explore and discover new strategies towards the sustainable combustion engine.

SPhERe
Spray Physics and Engine Research Lab

Bio: Dr. Caroline L. Genzale is an Assistant Professor in the Woodruff School of Mechanical Engineering at the Georgia Institute of Technology. Her research interests center on multiphase flows and combustion in direct-injection internal combustion engines. Prior to arriving at Georgia Tech, Dr. Genzale was a post-doctoral researcher at the Combustion Research Facility at Sandia National Laboratories in Livermore, CA, where she employed a variety of optical and laser-based measurement techniques to study fuel injection and spray-combustion processes for direct-injection gasoline and diesel engines. While working towards her Ph.D. in Mechanical Engineering from the University of Wisconsin – Madison, she developed engine CFD models and engine-design optimization tools for low-emissions diesel engines. Her dual experience in computational engine simulations and combustion experiments, forms the foundation for her unique integrated research approach at the Georgia Tech SPhERe Lab – a tight-coupling of high-fidelity model development and advanced optical measurements to accelerate fundamental understanding of fuel injection and in-cylinder combustion processes. She received the 2012 SAE John Johnson Award for Outstanding Contributions to Diesel Engine Research and has twice received an Outstanding Speaker Award from the Society of Automotive Engineers for presentations at the annual SAE World Congress.