The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar
Faculty Candidate

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Lecture Title: Current and future trends in automotive combustion research to meet the upcoming fuel economy targets

Friday, April 18, 2014 at 2:00pm, Room 173 Light Engineering Building

Abstract:

Due to governmental regulation, consumer requirements, and political and environmental factors, the demand for improved vehicle fuel economy has increased substantially in recent years. As a result, many new engine concepts, powertrain configurations, and energy storage and conversion technologies are being researched at university, government, and industry laboratories. The future of worldwide transportation will likely require a diverse compilation of energy conversion methods. Electric motors, hybrid powertrains, and combustion engines will all play a valuable role in fulfilling the requirements of the wide range of applications that depend on an on-board energy source. However, the inherent energy density advantage of the internal combustion engine using liquid hydrocarbons as the fuel, comparatively high efficiency and reliability, and low cost make it highly probable that the internal combustion engine will remain a cornerstone in transportation applications for the foreseeable future.

This presentation describes the recent trends in automotive combustion research that have the capability to meet the ambitious future regulation. Beginning with the near-term, the strategies for extending the limits and increasing the efficiency of spark ignited combustion are reviewed, including the challenges that arise from aggressive downsizing. As the presentation progresses, the discussion will become increasingly fundamental and shift toward advanced combustion modes. Low temperature combustion modes, like Homogeneous Charge Compression Ignition (HCCI), promise high thermal efficiencies with ultra-low soot and NO_x emissions by pairing the homogeneous, clean-burning nature of gasoline spark ignition combustion with the unthrottled, high efficiency of compression ignition (i.e. diesel) combustion. This presentation describes the current capabilities of HCCI combustion and a strategy to maximize the potential fuel economy benefit in a mid-sized vehicle. Finally, the research efforts to understand the fundamental physical phenomena that govern low temperature combustion are summarized.

Biography

Benjamin Lawler received his Doctorate in Mechanical Engineering from the University of Michigan in December of 2013, where he studied the effects of heat transfer and thermal conditions on advanced combustion strategies. In August of 2011, Dr. Lawler received his Master of Science in Engineering degree from the University of Michigan. At Michigan, Dr. Lawler was a recipient of the National Science Foundation Graduate Research Fellowship and a University of Michigan Mechanical Engineering departmental fellowship. His presentation at the 2012 American Society of Mechanical Engineers Internal Combustion Engine Division Spring Technical Conference in Torino, Italy was awarded “Best Presentation”, out-competing one hundred other papers and presentations. Before graduate school, Dr. Lawler graduated summa cum laude from the University of Massachusetts Amherst in May of 2008 with a Bachelor of Science in Mechanical Engineering. At UMass, Dr. Lawler achieved dean’s list every semester enrolled, he was a member of the Honors College, a member of the Golden Key National Honors Society, and chapter President of Pi Tau Sigma. He also held positions at UMass as a mentor to a residential academic program, physics and math tutor, undergraduate teaching assistant, and undergraduate research assistant.

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