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

Mechanical Engineering Seminar

William Northrop, Ph.D
Assistant Professor
Department of Mechanical Engineering
University of Minnesota

Lecture Title: Improving Engine Emissions and Efficiency with Premixed Compression Ignition Combustion

Friday, November 16, 2012 at 2PM, Room 173 Light Engineering Building

Abstract

A convergence is underway in internal combustion engines; gasoline and diesel engines are increasingly using premixed compression ignition (CI) combustion to control emissions and improve fuel economy. In modern diesels, premixed CI allows avoidance of fuel-rich and high temperature regions which simultaneously reduces NOX and soot formation, potentially eliminating the need for catalytic after treatment to meet emissions regulations. In practice however, this promising strategy is limited to low engine loads due to excessive peak pressure rise rate and suffers from high unburned hydrocarbon (HC) emissions from incomplete combustion. This lecture will focus on results from our work to both characterize and alleviate these disadvantages. One area of our research in premixed CI will be described; dual fuel reactivity-controlled compression ignition (RCCI) using alternative fuels. Recent studies have shown that very high thermal efficiencies are possible with RCCI. We have contributed to this finding by discovering that RCCI breaks traditional rules-of-thumb for combustion phasing in the engine cycle to achieve optimum thermodynamic cycle efficiency. Our work has also shown that RCCI can expand the types of fuels available for use in diesel engines. For example, syngas from the gasification of biomass can be used as the low reactivity fuel in RCCI to achieve high thermal efficiency while maintaining low exhaust emissions. The use of syngas in RCCI also allows interesting observations to be made concerning the source of HC emissions in premixed CI combustion modes. Planned future research will also be presented to use a novel on-board fuel reforming strategy to modulate fuel reactivity real-time and enable RCCI to be implemented with a single stored fuel.

Biography

Will Northrop is an assistant professor in mechanical engineering at the University of Minnesota and is a principle investigator in the Center for Diesel Research. Dr. Northrop received a Ph.D. in mechanical engineering from University of Michigan in 2009. After receiving his degree, he held the position of Senior Researcher at General Motors Research and Development where he worked in the Propulsion Systems Research Laboratory. Dr. Northrop's research interests are in the areas of energy conversion, advanced combustion in engines, alternative fuels and emissions characterization.

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