2009-2010

# Graduate Seminar Series

## The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Dr. Mark Musculus

Sandia National Laboratories

Dr. Mark Musculus earned a B.S. in Mechanical Engineering in 1992 from Michigan Technological University, and M.S. and Ph.D. degrees in 1994 and 1998 from the Engine Research Center at the University of Wisconsin, Madison. Since then, he has been a scientist in the Engine Combustion Department of the Combustion Research Facility (CRF) at Sandia National Laboratories, Livermore, California. (http://www.ca.sandia.gov/crf/research/combustionEngines/index.php). His research focuses on providing a detailed, science-based understanding of new, clean combustion strategies for high fuel-efficiency internal combustion engines. He uses advanced optical and laser-based diagnostic techniques coupled with high-speed, intensified cameras to probe the combustion processes of operating engines.

**Thursday, Apr. 22, 2010 3:00 – 4:00 p.m. Room 112, ME-EM Bldg.**

## Laser-Based Imaging of Combustion Processes in Clean Diesel Engines

Our nation is facing serious energy challenges resulting from our dependence on imported oil, rising greenhouse gas concentrations in the atmosphere, and air pollution from burning fossil fuels. To help meet these challenges, a better understanding of the in-cylinder processes of internal combustion engines that create pollutant emissions at high-efficiency operation conditions is required. Using various laser-based optical diagnostics in an optically acessible heavy-duty diesel engine at the Combustion Research Facility of Sandia National Laboratories in Livermore, California, we are developing a new understanding of the physical and chemical processes of new clean-diesel operating modes. This presentation will start with a broad overview of the current energy and environmental challenges facing our country, followed by a brief review of our current understanding of conventional diesel engine technologies gained by laser-based optical diagnostics. Then, one approach to clean diesel combustion, EGR-diluted low-temperature combustion with extended premixing, will be described. One of the challenges facing this new engine operation mode is excessive unburned hydrocarbon emissions. Recent experimental work to understand the in-cylinder mechanisms responsible for the unburned fuel emissions, along with a discussion of fuel ignition chemistry, will be provided. The presentation will conclude with an outlook for future engine technologies.

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