

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: Multi-Physics Modeling of Advanced Powertrains**

Friday, September 23, 2011, 11:30AM, Room 173 Light Engineering

#### **Abstract**

The automotive industry is constantly facing the challenge of improving vehicle fuel economy and reducing emissions without sacrificing performance. Novel combustion concepts (e.g. homogeneous charge compression ignition – HCCI), as well as recent advances in engine technology (e.g. variable valve actuation) and electrical components (e.g. batteries) offer the promise of dramatic gains in vehicle fuel economy. In order to take full advantage of these new technologies, however, it is important to enhance our fundamental understanding of the combustion processes, while addressing the increased complexity of the engine and vehicle systems. This presentation demonstrates how multiphysics models of varying complexity and fidelity can be used to aid the development of an advanced engine and evaluate the potential overall fuel economy improvements at the vehicle level. More specifically, a CFD model with detailed chemical kinetics is used to investigate HCCI combustion and understand the effects of combustion phasing and engine load/speed on burn rates and combustion efficiency. The CFD results are then used to derive a system level model that can aid in the design of the engine system, component matching, and controls development. Finally, the engine system model is employed to generate engine fuel consumption maps that can be incorporated in vehicle level simulations for assessing the overall fuel economy gains over a given drive-cycle. The presentation will end with the introduction of an innovative power generation unit for use in hybrid electric vehicles: a free piston engine coupled with a linear alternator, which allows the direct conversion of the piston kinetic energy to electricity.

#### **Biography**

Dr. Aris Babajimopoulos received his Ph.D. degree in Mechanical Engineering in 2005 and M.Sc. in Mechanical Engineering in 2002 from the University of Michigan. Since 2006, he has been an Assistant Research Scientist in the Department of Mechanical Engineering at the University of Michigan.

