2012-2013

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Professor Robert J. Santoro, the George L. Guillet Professor of Mechanical Engineering
Department of Mechanical and Nuclear Engineering
The Pennsylvania State University

ROBERT J. SANTORO, George L. Guillet Professor of Mechanical Engineering, received his Ph.D. degree in physics from Boston College in 1975. He then joined the Department of Mechanical and Aerospace Engineering at Princeton University as a research engineer. In 1978, he joined the National Bureau of Standards (now the National Institute of Standards and Technology) in Washington, D.C., where he remained until 1986. At NBS, Dr. Santoro developed research efforts in the areas of particle formation in flames, laser tomography, and spray combustion research. In 1986 he joined the Pennsylvania State University as an associate professor of mechanical engineering and was promoted to full professor in 1990. In 1994, Dr. Santoro was appointed to the position of Director of the Propulsion Engineering Research Center and promoted to Distinguished Professor of Mechanical Engineering in 2000. In 2003 Dr. Santoro was named as the George L. Guillet Professor of Mechanical Engineering and elected a Fellow of the ASME. In 1985 he was awarded the U.S. Department of Commerce Silver Medal for his research in soot particle formation. Dr. Santoro is also active in the AIAA, ASME and Combustion Institute where he has organized numerous sessions for national meetings. He serves as an Associate Editor for Combustion, Science and Technology and is on the editorial advisory board of the Progress in Energy and Combustion Science. His research interests include studies of rocket propulsion, rocket-based combined cycle engines, combustion of coal-based fuel, soot formation in flames, liquid spray combustion, laser diagnostics, gas turbine combustion, combustion instability, and chemical kinetics.

Thursday, Oct. 25, 2012 **4:00 – 5:00 p.m.** **Room 112, ME-EM Bldg.**

Soot formation studies using JP-8 and JP-8 surrogate fuels

Design methodologies for practical combustion systems using Computational Fluid Dynamic (CFD) tools have been a focus for fundamental and applied research for at least three decades. One of the challenges faced in developing CFD design tools lies in how to simulate the chemical kinetics of practical fuels that contain hundreds components. Consequently, development of surrogate fuels containing a small number of components that replicate the combustion of practical fuels is an active research topic. Recently, a team of researchers from Princeton University, University of Connecticut, University of Illinois at Chicago and Penn State University completed a five year study to develop a methodology for making a surrogate fuel to simulate the combustion of the current fuel used by the U.S. Air Force, JP-8. This methodology relies on matching four parameters: H/C ratio, molecular weight, derived cetane number and sooting threshold index of the practical fuel. The composition of the surrogate fuel includes several families of hydrocarbon compounds: n-alkanes, branched-chain alkanes, cycloalkanes and aromatics. Concurrently, chemical kinetic models that include oxidation chemistry for the surrogate components were developed by some of the team members. In this talk, the emphasis will be on the work done at Penn State to simulate the sooting characteristics of the surrogate fuels. In addition, the basis for the selection of four parameters used to identify suitable surrogate components and results from the chemical kinetic modeling studies will be presented.

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