Combustion Theory and Modeling Towards Alternative Fuels

Yiguang Ju

Professor
Department of Mechanical and Aerospace Engineering
Princeton University

Thursday, April 12, 2012
3:00 P.M.
ARMS 1109

Abstract
Recent concerns over energy sustainability have presented great challenges to develop quantitatively predictive models to enable new technologies and renewable fuels for energy systems to increase energy conversion efficiency and reduce emissions. This talk will present a summary of the recent progresses in experimental and kinetic studies of transportation fuels as well as plasma assisted combustion. The talk will discuss the challenges of experiments and kinetic modeling of ignition, extinction, and emissions at high pressures using various alternative fuels with different functional groups. A generic concept of surrogate fuel model using a few selected component fuels to model the burning and emission properties of real fuels will be presented and validated. A comprehensive correlation between flame extinction and fuel functional groups will be discussed. A multi-time scale model to achieve efficient modeling of combustion with a detailed mechanism will be presented. The theory of flame initiation will be revisited and the important length scales which govern the minimum ignition energy and flame extinction will be analyzed. Based on the theoretical and kinetic understanding, a non-equilibrium plasma assisted combustion technology to achieve low temperature ignition and enhance flame stabilization will be presented.

Bio
Yiguang Ju received his undergraduate BSE from Tsinghua University in 1986, and his PhD degree from Tohoku University (Japan) in 1994. He was appointed to the assistant and associate professor ranks at Tohoku University in 1995 and 1998, and as a Yangzi River Professor at Tsinghua in 2000. He joined Princeton University as an assistant professor in 2001 and became to full professor in 2011. Prof. Ju’s research interests include combustion, fuels, propulsion, environment, and functional nanomaterials. He has published more than 110 refereed publications. He is an ASME Fellow and an Associate Fellow of AIAA. He was awarded by the ASPACC Young Investigators Award (1999) at the First Asia Pacific Conference on Combustion, the Best Paper Award (1999) by the Japan Society for Aeronautical and Space Sciences, the Yangzi River Scholar Award (2000) by the Chinese Education Ministry, A Distinguished Paper Award from the Thirty-third International Symposium on Combustion, NASA Certificate of Appreciation, and Friedrich Wilhelm Bessel Research Award by The Alexander von Humboldt Foundation.

An informal coffee & cookie reception will be held prior to the lecture at 2:30 p.m. in the AAE/ARMS undergraduate lounge (directly in front of ARMS 3rd floor elevators).