2011-2012

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Professor Jong Guen Lee
Ohio Research Scholar
School of Aerospace Systems
University of Cincinnati

Jong Guen Lee is an Ohio Research Scholar Chair in the School of Aerospace Systems, University of Cincinnati. His research focuses on combustion and propulsion issues in air-breathing and rocket propulsion systems. He has many years of experience in combustion dynamics in gas turbine, ramjet and augmentor, development of various laser-based optical diagnostic techniques with applications to propulsion systems, combustion control and sensors monitoring the combustion process, turbulent flame propagations and multi-phase combustion processes. He has been collaborating with many major gas turbine/aircraft industries such as GE Aviation, GE Energy, Pratt and Whitney, Siemens-Westinghouse, Solar Turbines as well as the NASA-GRC, Wright-Patterson AFB and DOE NETL in those areas. His research interests also include supersonic combustion, plasma-aided combustion, solid-propellants and combustion of alternative fuels.

Thursday, Sept. 29, 2011 4:00 – 5:00 p.m. Room 112, ME-EM Bldg.

"Various research topics on Combustion/Propulsion/Energy System"

The seminar will give a brief summary on various research topics in combustion/ propulsion/ energy areas which include the combustion dynamics in advanced gas turbine engines, the combustion of nano-energetics and the development of advanced propulsion/energy systems.

Combustion instabilities pose significant operational problems for gas turbine engines. Most of these instabilities involve a resonant coupling between the combustion-generated heat release rate and acoustic waves in combustor. One important factor required to understand combustion instabilities is to know how the flame responses to acoustic perturbations. This, so-called flame transfer function, has been determined for various nozzles. Some of the results will be presented and the phenomenology of flame response to inlet velocity and fuel modulation will be discussed.

Thermite reactions with nanoscale particles have attracted much study due to their high flame temperatures and combustion velocities. However, the mechanism by which the reaction propagates is not well understood. The fuel and oxidizer particle sizes of Al/CuO and Al/MoO_3 thermites were varied between the nanometer and micrometer scale, are presented to gain further insight into the factors governing their rate of propagation. Critical properties, including linear propagation rates, dynamic pressure, spectral emission and burning temperature, were measured and compared to address the flame propagation mechanism.

Currently, there is a high demand for smaller satellites and thus smaller load areas, which in turn require better onboard power sources. SOFCs (Solid Oxide Fuel Cells) can incorporate an electric generator into a system that will run off of the gases created during combustion from the onboard thrusters of satellite systems. The SOFC can generate power from the exhaust gases created by the thrusters and store the electric output into a super capacitor to use at a later time. This eliminates the need for an onboard battery or other types of electric storage units, lowering the overall weight and size. A unique concept developed to achieve this and its feasibility will be discussed.

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