College of Engineering
Department of
Mechanical & Industrial Engineering

The Robert W. Courter Seminar Series

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1221 Patrick F Taylor Hall

Multiphase flow research for energy and propulsion applications

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As we seek power generation and propulsion systems with higher efficiencies and lower emissions, we are increasingly turning to alternative fuels and advanced engine configurations operating at conditions significantly differently from conventional systems. This brings challenges, but also brings opportunities - such as the ability to use non-intrusive diagnostic techniques to study complex flows in-situ, the ability to leverage advanced manufacturing techniques and materials to achieve step-changes in system performance, and the ability to employ advanced computational methods and increasing computing power to gain insight into micro-scale physical processes driving device-level phenomena. The research focus of the Energy and Propulsion Laboratory at LSU is on studying the underlying fluid dynamic, chemical kinetic, and heat and mass transfer phenomena involved in multiphase flows with relevance to power generation and propulsion. Gas phase flows with dispersed liquid droplets or solid particles are the two forms of multiphase flows primarily studied in our laboratory. We have studied a broad spectrum of such flow configurations in low- and high-speed, and reacting- and non-reacting environments using experimental and computational techniques. The driving motivation for our research is that a detailed understanding of multiphase flows, particularly at the scale of the dispersed phase, is the essential knowledge gap limiting the performance of power generation and propulsion devices encountering such flows. By simplifying complex device-level phenomena to canonical problems that can be studied in detail in a controlled environment, we seek to uncover fundamental knowledge to help improve device-level performance. In this talk I will give an overview of some of the multiphase research projects that have been undertaken in our laboratory. Experimental and computational approaches and relevant results will be presented for studies on: oscillation dynamics of droplets in ambient air, liquid jet and spray interaction with supersonic air flow, surface-impinging particle-laden gas flows, shock-induced liquid droplet breakup, and melt-layer combustion relevant to hybrid rocket motors.

*Dr. Shyam Menon received his MS and PhD degrees from the Aerospace Engineering department at the University of Maryland at College Park (UMD). He previously received a BE degree in mechanical engineering from VJTI, Mumbai, India. After completing his PhD work, he conducted post-doctoral research at the California Institute of Technology (Caltech), the University of Southern California (USC), and the Oregon State University (OSU). Since 2016, he has been appointed as a tenure-track assistant professor in the Mechanical and Industrial Engineering (MIE) department at Louisiana State University (LSU). He has established the Energy and Propulsion Laboratory (EPL) at LSU where the focus is primarily on multiphase flow research with application to power generation and propulsion. His research background involves fundamental and applied studies on combustion and reacting flow, droplet and spray dynamics, supersonic flow and shock wave phenomena, particle-laden flows, and alternative fuels including bio-fuels and ammonia.