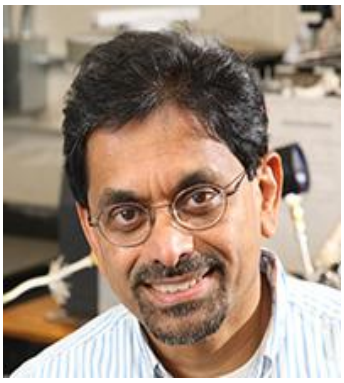
UNIVERSITY OF MARYLAND

A SEMINAR ON THE CHALLENGES IN THERMAL MANAGEMENT AND FLAME STABILIZATION

HYPERSONIC PROPULSION

Thursday, May 3, 2018
3 to 4 p.m.
DeWalt Seminar Room



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ABSTRACT

Over the last six decades, research on hypersonic propulsion has seen several cycles of resurgent interest, typically at fifteen to twenty year intervals. We are currently in the midst of another peak cycle that has attracted tremendous worldwide interest. The fundamental challenges however, remain almost the same, i.e. inlet design and mass capture, shockwave-boundary layer interactions, flow distortion and fuel-air mixing, flame holding over recirculation regions, turbulence-chemistry interactions, thermal management with endothermic fuels, etc. Advances in high-temperature materials and metal additive manufacturing capabilities are expected to rapidly accelerate the process of finding engineering solutions to several of the above challenges.

In this presentation, recent work at the University of Virginia on the endothermic-fuel cooling concepts (with and without catalysts) and flame stabilization under dual-mode combustion conditions will be discussed. Specifically, our attempts to better understand the catalytic vs. pyrolytic cracking of endothermic fuels and subsequent coking effects in cooling channels will be presented. In addition, our search for optimal fuel-catalyst pairing, including additively manufactured cooling channels with Inconel 718 will be discussed. With regard to flame stabilization, a host of advanced non-intrusive diagnostic methods (PIV, high resolution OH and CH2O PLIF, hybrid fs/ps CARS) and computational methods (DNS/LES) are being deployed to better understand the fundamental turbulent flame structure/regimes and flame stabilization mechanisms. In particular, effects of fuel-air premixing, scaling of the cavity recirculation region, and turbulent effects on the flame structure will be presented.

BIO

Harsha Chelliah is a professor in Mechanical and Aerospace engineering at the University of Virginia. He received his PhD in Mechanical and Aerospace Engineering from Princeton University in 1988. His research is focused on fundamental interactions between finite-rate kinetics and fluid flow using both experimental and modeling approaches. He has developed several unique high-pressure reactors to investigate fundamental issues related hypersonic and gas-turbine propulsions systems. He is an active member of the Combustion Institute and the American Institute of Aeronautics and Astronautics. He is also a member of the editorial board of the Combustion Theory and Modeling Journal. He is an Associate Fellow of AIAA, Visiting Fellow at Peterhouse College, Cambridge University, and the 2016 Thomas Jefferson Visiting Fellow at Downing College, Cambridge University.

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