JOHNS HOPKINS
Center for Environmental
& Applied Fluid Mechanics

Friday, April 13, 2018
3:00 PM, 132 Gilman Hall

"*Flow Physics of Laminar and Turbulent Separation Bubbles*"

Presented by Dr. Wen Wu

Johns Hopkins University – Department of Mechanical Engineering

Abstract: Separation bubbles are ubiquitous in external as well as internal aerodynamics: wings and fuselages at high angles-of-attack, flow past external protuberances (turrets, struts, nacelles, stores, and armament), shock-wave/boundary layer interactions, diffusers, corners, and junctions are just a few examples of this kind of flow. The dynamics of a turbulent separation bubble is dominated by two distinct modes: a low frequency "breathing" or "flapping" mode (St ~ 0.01) and a medium frequency "shedding" mode (St ~ 0.35). This unsteadiness leads to many issues in applications, such as degradation to system performance and aerodynamic noise. It also brings additional difficulties to the prediction of flow separation due to the complexity of intermittency. Better and more sophisticated tools are required for analysis of such unsteadiness. We focus on both natural (unperturbed) as well as perturbed laminar separation bubble and separation bubble. High-fidelity numerical simulations are utilized to studying the mechanisms that generate and govern the oscillation. These efforts aim to improve the understanding of the causal mechanisms, scaling laws, and nonlinear dynamics associated with the unsteadiness of flow separation and advance efforts for flow-control technology.

Bio: Wen Wu is a postdoc scholar of Mechanical Engineering at JHU. He received his M.S. from University of Science and Technology of China, and Ph.D from Queen's University. His previous research was focused on the effects of realistic complexities, including embedded large-scale vortices, surface roughness, freestream adverse pressure gradient and rotation, on the dynamics of turbulent boundary layer. His research interests lie in the development of advanced numerical methods for understanding non-equilibrium flows. His other research interests include multiphase flows, turbulent combustion and environmental flows. Dr. Wu current focuses on understanding of the flow-physics and non-linear dynamics of turbulent separation bubbles using high-fidelity numerical simulations.