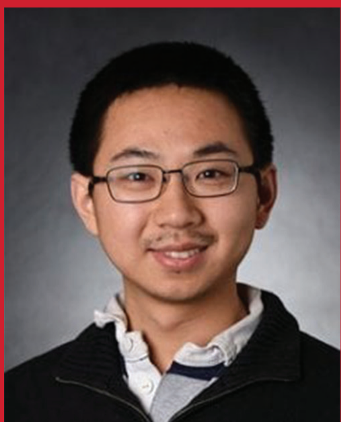
IOWA STATE UNIVERSITY
Department of Aerospace Engineering

Guest Seminar



Dr. Xiang Yang

Assistant Professor, Department of Mechanical Engineering, Pennsylvania State University

Mean Flow Scaling for Boundary Layers with Arbitrary Pressure Gradients

Boundary layers subject to pressure gradients are prevalent in fluid dynamics. The conventional law of the wall (LoW) fails to capture the flow behavior in these scenarios, particularly due to the presence of history effects. In this seminar, we explore advancements aimed at overcoming this limitation through the introduction of a universal mean flow scaling for boundary layers influenced by pressure gradients. We examine the applicability of our transformation across diverse flow situations, including channels experiencing an abrupt change in its forcing and Couette-Poiseuille flows. Further, we discuss the implementation of a velocity transformation for near-wall turbulence modeling within the Reynolds-averaged Navier-Stokes (RANS) framework. The resulting model incorporates an additional transport equation designed to track the Lagrangian integration of total shear stress. Additionally, the seminar will highlight our research on near-wall turbulence modeling for high Mach number and separated flows within the RANS context, extending the scope of our study beyond pressure gradient-affected boundary layers.

February 29, 2023
2:10 p.m.

1235 Howe Hall

Iowa State University

Dr. Xiang Yang is an Assistant Professor in the Department of Mechanical Engineering at Pennsylvania State University. He completed his Ph.D. in Mechanical Engineering at Johns Hopkins University in 2016. Following his Ph.D., Dr. Yang joined the Center for Turbulence Research as a Postdoctoral Research Fellow in 2016, before taking up a position at Penn State's Mechanical Engineering Department in 2018, where he has continued his work to date. He was awarded the American Physical Society Division of Fluid Dynamics Best Thesis Award in 2017 and received the Air Force Office of Scientific Research Young Investigator Award in 2022. Dr. Yang's research focuses on high-fidelity numerical simulations of turbulent flows, turbulence modeling that integrates physics and data insights, and advancing turbulence theories. He has authored and co-authored over 90 journal articles to date.