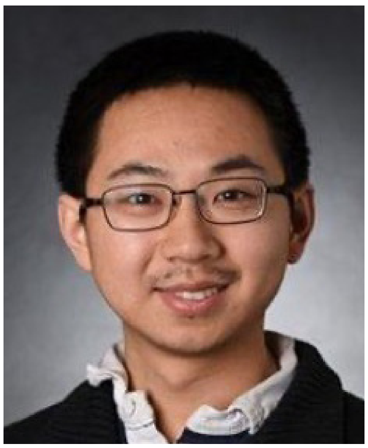
UNIVERSITY OF MARYLAND

THE BURGERS PROGRAM FOR FLUID DYNAMICS
THE FLUID DYNAMICS REVIEWS SEMINAR SERIES

MEAN TEMPERATURE SCALING IN HIGH-SPEED BOUNDARY-LAYER FLOWS AND THEIR APPLICATIONS IN NEAR-WALL TURBULENCE MODELING



Friday, December 9, 2022 | 11am

Aerospace Engineering Conference Room
3164 Glenn L. Martin Hall

Speaker

DR. XIANG YANG

Assistant Professor
Mechanical Engineering
Pennsylvania State University

ABSTRACT

The logarithmic law of the wall and the Reynolds analogy together give rise to the logarithmic scaling of the mean temperature. This scaling loses its predictive power in high-speed boundary-layer flows because of varying fluid density and, more importantly, aerodynamic heating, a term that has no counterpart in the momentum equation. This talk will first discuss how one may account for aerodynamic heating in a temperature transformation. The method is modular. That is, it may be incorporated into any existing transformation. Furthermore, it provides a unified description of isothermal and adiabatic walls---describing the behavior of the mean temperature in the latter has been a long-standing challenge. After establishing a temperature transformation, this talk will discuss its application in near-wall turbulence modeling. A new turbulent Prandtl number is derived and tested in wall-modeled large-eddy simulations. We show that the present formulation gives more accurate predictions for the mean temperature.

BIO

Dr. Xiang Yang is an Assistant Professor in the Mechanical Engineering Department at the Pennsylvania State University. He received his Ph.D. in Mechanical Engineering from Johns Hopkins University in 2016. After that, Yang joined the Center for Turbulence Research in 2016 as a Postdoctoral Research Fellow. He became a faculty member in the Mechanical Engineering Department at Penn State in 2018 and has been there since then. His group conducts high-fidelity numerical simulations, builds physics- and data-based models, and finds efficient solutions for real-world engineering problems. His group uses tools including direct numerical simulation, large-eddy simulation, Reynolds-averaged Navier Stokes, and machine learning.

University of Maryland 1856
A. JAMES CLARK SCHOOL OF ENGINEERING