

Date: September 17th

Time: 10:30 AM

Location: Olin 305

Speaker: Dr. Werner J. A. Dahm
Laboratory for Turbulence & Combustion (LTC)
Department of Aerospace Engineering
The University of Michigan

Title: "True Turbulence: Towards a Physically-Based Model of Turbulent Flows"

Abstract

This seminar presents a fundamentally new approach to subgrid-scale modeling of the intermediate and small scales of turbulent flows. It first summarizes recent experimental results from DSPIV measurements of velocity gradient fields in turbulent shear flow, and uses these to obtain insights into multifractal scale-similarity in the enstrophy and dissipation rate fields. This scale-similarity forms the basis of a new physically-based approach to subgrid-scale modeling for large eddy simulations. A scale-invariant multiplicative cascade gives the distribution of subgrid vorticity magnitudes within each resolved-scale cell, and an additive cascade gives the progressively isotropic decorrelation of subgrid vorticity orientations from the resolved scale D to the viscous scale l_n . The subgrid velocities and stresses are then obtained from Biot-Savart integrals over this subgrid vorticity field. The resulting multifractal subgrid-scale model gives remarkably good agreement in a priori tests with DNS data, as well as in a posteriori tests in an LES code.