Date: February 22

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Dr. James Wallace

University of Maryland

Title:*"Twenty years of experimental and DNS access to the velocity gradient tensor: What have we learned about turbulence?"*

Abstract

Twenty years ago there was no experimental or computational access to the velocity gradient tensor for turbulent flows. Without such access, knowledge of fundamental and defining properties of turbulence such as vorticity, dissipation and strain rates and helicity were also not accessible. In 1987 the results of the development and first successful use of a multi-sensor hot-wire probe for measurements of all the components of the velocity gradient tensor in a turbulent boundary layer were published (J.-L. Balint, P. Vukoslavevic & J. Wallace, *Advances in Turbulence, Proceedings of the 1st European Turbulence Conference,* G. Comte-Bellot and J. Mathieu eds. Springer). That same year the first DNS of a turbulent channel flow was successfully carried out (J. Kim, P. Moin & R. Moser, *J. Fluid Mech.* **177,** 133-166) and reported. Also, in that year, DNS of homogeneous turbulent shear flow (M. Rogers & P. Moin, *J. Fluid Mech.* **176**, 33-66) and of isotropic turbulence (W. Ashurst, A. Kerstein, R. Kerr & C. Gibson, *J. Fluid Mech.* **176** 33-66) were reported and many interesting aspects of their structure were discussed. Since then several experimentalists have used multi-sensor hot-wire probes of increasing complexity in turbulent boundary layers, wakes, jets, mixing layers and grid flows. Numerous computationalists have employed DNS in a wide variety of turbulent flows at ever increasing Reynolds numbers. PIV has been developed and advanced during these two decades and has provided another means of access to these fundamental properties of turbulence. This presentation will review these developments and point out some of the most important things we have learned about turbulence as a result.