

Weekly Seminar: Fall 2010

Date: Friday September 24

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Mark Glauser (Syracuse University)

Title: *"Closed-Loop Control of Turbulent Flows"*

Abstract

We are developing closed-loop flow control methods based on the use of Proper Orthogonal Decomposition (POD) and Stochastic Measurement (SM) for various turbulent flows including; that over a NACA 4412 airfoil, turbulent jets for noise reduction/enhanced mixing, 3D separated flow control over turrets for improving aero-optics and for improving efficiency and reducing noise on large wind turbines. The approach involves using a combination of Particle Image Velocimetry (PIV) and multiple surface pressure measurements for the airfoils and turret or near field pressure and far field noise measurements for the jet, processed through POD/SM algorithms, from which estimates of the velocity field via pressure alone are extracted. From such estimates knowledge of the state of the flow can be obtained. Integral to the POD/SM algorithm is the measurement estimation of the global POD coefficients. Over the past 4 years or so we have demonstrated the utility of these time dependent coefficients for use in simple proportional feedback loop (as the time series to drive the actuators) to achieve the desired control objective. This methodology is critical for implementation of realistic feedback flow control since practical measurements and not inflow velocity measurements are required for most applications. The talk will be focused on our recent joint SU/AFRL closed loop flow control results for improving the aero-optics over a dynamically articulating turret at various speed ranges. If time permits, a quick overview will also be provided of our flow control research on high speed jet noise reduction and increased efficiency and noise reduction for large scale wind turbines.