Boulder Fluid Dynamics Seminar Series

Tuesday, October 15, 2013
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Design Optimization of Downwind Rotors with Segmented Blades

Andrew Ning, *National Wind Technology Center, NREL*

Large wind turbine rotor blades are often constrained by the stiffness required to prevent a tower strike. By using a downwind configuration, large blades may be able to reduce their mass significantly. Large rotors for land-based applications are also often constrained by transportation limitations. Segmented blade designs would accommodate the transportation of larger blades. The combination of a downwind rotor with segmented blades provides a synergistic benefit where larger blades with higher energy capture can be utilized without incurring large increases in mass. Large upwind and downwind rotors are compared using nonlinear optimization to minimize cost of energy subject to a subset of IEC design criteria.

Conservation of Geometry and Physics in Numerical Modeling of Incompressible Flow

John Evans, *University of Colorado at Boulder*

The incompressible Navier-Stokes equations are infused with important physical structure, evidenced by a wide array of balance laws for momentum, energy, vorticity, enstrophy, and helicity. The key to unlocking this structure is precisely the volume-preserving nature of incompressible flow, yet most numerical methods only satisfy the incompressibility constraint in an approximate sense. Consequently, such methods do not obey certain fundamental laws of physics and produce unphysical results for many flow configurations of interest. In this talk, I will discuss recently developed spline discretizations which satisfy the incompressibility constraint point-wise and hence replicate the balance law structure of the Navier-Stokes equations. I will give a brief overview on how to construct such discretizations, discuss their relationship to standard finite element, finite volume, and spectral methods, and present numerical results illustrating their promise in the context of low-speed flows.