Boulder Fluid Dynamics Seminar Series

Tuesday, August 6, 2013
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Ocean predictions and uncertainty estimates

Nadia Pinardi, *University of Bologna*

Ocean Forecasting has started in the eighties in limited ocean regions and now it is a reality in the global open ocean and coastal regions. Predictability of oceanic flows is connected, as for the atmosphere, to initial condition inaccuracies and to model representation errors, both numerical and process wise. To this common set of uncertainty sources the ocean forecasting adds the uncertainty about atmospheric forcing and especially the wind stress, the major forcing of the ocean circulation. The effects of uncertainties is reviewed and forecast errors discussed for the Mediterranean Sea where a real time ocean-prediction system is in place.

Computational aerodynamics at the US Air Force Academy

Andrew Lofthouse, *US Air Force Academy*

For the past 10 years, the Modeling & Simulation Research Center (MSRC) of the US Air Force Academy has created an environment that allows faculty and cadets to take advantage of computing performance increases to perform cutting-edge, defense-focused, modeling and simulation research. Whether it's the modest, in-house cluster of 144 computational cores or the nearly-75,000-computational-core supercomputer housed at the Air Force Research Laboratory, the MSRC provides access to the computational power needed to tackle science and engineering's largest, most complex problems. Computational Fluid Dynamics (CFD) work has been the foundation of the MSRC since its inception, and it continues to be at the forefront of the center's emphasis on the Academy's learning-focused paradigm. Computational modeling and simulation is integrated throughout the Department of Aeronautics curriculum, giving every Aeronautics cadet a foundation in the capabilities of computational aerodynamics.

This presentation will give a brief overview of the history and heritage of the MSRC, and the role of computational aerodynamics in the Aeronautics curriculum. More recent faculty and cadet-run applied aerodynamics research using CFD methods will be presented. These research projects range from an aerodynamic analysis of a supersonic ultimate land-speed record car, to stability and control estimation methods, in conjunction with several NATO task groups that have included 46 participants from 12 countries. The objective of the task groups is to determine an overall strategy for creating stability and control databases for vehicle simulation at full-scale conditions, throughout the operational envelope of the vehicle using computational methods. As part of the NATO research, current MSRC researchers have developed methods for reduced-order-modeling of aircraft stability characteristics during complex maneuvers. Three-dimensional, time-accurate, full-aircraft CFD simulations are used to develop reduced-order models that capture unsteady, nonlinear physics and can help reduce the amount of wind tunnel and flight testing required to determine full-scale aircraft aerodynamics.