

Boulder Fluid Dynamics Seminar Series

Tuesday, January 21, 2014

3:30pm-4:30pm (refreshments at 3:15pm)

Bechtel Collaboratory in the Discovery Learning Center (DLC)

University of Colorado at Boulder

Wavelet Methods in Computational Fluid Dynamics

Oleg V. Vasilyev, *University of Colorado at Boulder*

Wavelet methods in Computational Fluid Dynamics is a relatively young area of research. Despite their short decade-long existence, a substantial number of wavelet techniques have been developed for numerical simulations of compressible and incompressible Euler and Navier–Stokes equations for both inert and reactive flows. What distinguishes wavelet methods from traditional approaches is their ability to unambiguously identify and isolate localized dynamically dominant flow structures such as shocks, flame fronts or vortices and to track these structures on adaptive computational meshes. This lecture will provide a general overview of wavelet methods for solution of partial differential equations and describe different numerical wavelet-based approaches for solving the Navier–Stokes and Euler equations in adaptive wavelet bases as well as provide the background how to use wavelet-based methods for flows in complex geometries.

Cyclostationary Empirical Orthogonal Functions: Technique and Application

Benjamin Hamlington, *CIRES, University of Colorado at Boulder*

The decomposition of data in terms of a set of basis functions is often very useful in understanding the complicated response of a physical system. By decomposing into less complicated patterns, it may be easier to understand and shed light into the nature of the variability in a dataset. The concept of cyclostationary empirical orthogonal functions (CSEOFs) was introduced in an attempt to more compactly capture the time-varying spatial patterns and longer-timescale fluctuations present in geophysical signals when compared to traditional empirical orthogonal function (EOF) analysis. Here, we discuss CSEOF analysis and compare and contrast to other EOF-based techniques. Previous applications of CSEOFs will be described to help motivate the possible extension of the technique into new areas.