Center for Fluid Mechanics, Division of Applied Mathematics
Fluids and Thermal Systems, School of Engineering
Joint Seminar Series

TUESDAY – NOVEMBER 5, 2013
3:00pm
Barus & Holley, Room 190

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Cambridge, M

Reduced-order Stochastic Modeling and Probabilistic Prediction of Turbulent Dynamical Systems with Intermittent or Persistent Instabilities

Various contemporary research topics involve the understanding, modeling, and prediction of complex turbulent systems with an important number of instabilities. Topics of this kind include the probabilistic quantification of low-Re laminar but unstable fluid flows, the reduced-order modeling of low-dimensional quantities of interest for high-Re turbulent flows with a very large number of persistent instabilities, as well as the quantification of low dimensional, intermittent structures, such as extreme events, that occur in wave systems characterized by broad spectra. In this talk three recent approaches involving the above topics will be discussed: 1) The dynamically orthogonal (DO) field equations for the detailed stochastic modeling of low-dimensional attractors of dynamical systems that have a small number of instabilities, 2) The reduced-order modified quasilinear gaussian (ROMQG) closure for the modeling of low dimensional quantities of interest for turbulent systems characterized by a very large number of instabilities (joint work with Andy Majda - NYU), and 3) A blended approach for the quantification and prediction of low-dimensinal, intermittent events in dispersive, nonlinear waves with broad spectra (joint work with William Cousins - MIT).