



ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE

*Prof. Jan Hesthaven*

*Mathematics Institute of Computational Science and Engineering - MATHICSE*

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## ***SEMINAR OF NUMERICAL ANALYSIS***

➤ **THURSDAY 19 DECEMBER 2013 - ROOM MA A1 12 - 15h00**

*Prof. Daniele Venturi (Brown University, Providence, USA)* will present a seminar entitled:

### **"A new framework for stochastic analysis in large scale simulations based on convolutionless Nakajima-Zwanzig PDF equations"**

Abstract:

Determining the statistical properties of stochastic nonlinear systems is of major interest across many disciplines. Currently, there are no general efficient methods to deal with this challenging problem that involves high dimensionality, low regularity and random frequencies. In this talk we present a new framework for stochastic analysis in large scale simulations based on goal-oriented probability density function (PDF) methods.

The key idea stems from techniques of irreversible statistical mechanics, in particular the convolutionless Nakajima-Zwanzig-Mori formalism, and it relies on deriving evolution equations for the PDF of low-dimensional quantities of interest, e.g., functionals of the solution to systems of stochastic ordinary and partial differential equations. We address the question of approximation of reduced-order PDF equations by multi-level coarse graining, perturbation series and operator cumulant resummation. This new theoretical approach is useful to many disciplines and it could lead to new and more efficient computational algorithms. Numerical examples are presented for stochastic resonance, stochastic advection-reaction and Burgers equations.

Lausanne, 2 December 2013/JH/cr

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The seminars taking place at the Section of Mathematics are announced on internet address : [www  
http://mathicse.epfl.ch/seminars](http://mathicse.epfl.ch/seminars)