## TEXAS TECH UNIVERSITY
## Mechanical Engineering Seminar Series

Dr. Luminita Danaila
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### "Similarity of Variable Viscosity Flows"

**Abstract**

The focus of the talk is on variable-viscosity flows and mixing in density-matched fluids. The issue is whether or not these flows may be self-similar or self-preserving. The importance of the question stands on the predictability of these flows; self-similar dynamical systems are much easier tractable from an analytical viewpoint. Self-similarity analysis, as first introduced by Townsend, is applied to the relevant transport equations of the velocity field (mean momentum, one-and two-point energy budget equations). It is stressed that neither local isotropy nor high Reynolds numbers are necessary conditions for the similarity to be valid. Energy budget equations are developed for flows in which the viscosity varies as a result of heterogeneous mixture or temperature variations. Additional terms are highlighted, accounting for the viscosity gradients, or fluctuations. These terms are present at both small and large scales, thus rectifying the common belief that viscosity is a small-scale quantity. This will be illustrated with an analysis of a temporally evolving mixing layer, and of a round jet evolving in a more viscous fluid. In the central region of the jet, it will be shown that the condition of self-similarity is not necessarily satisfied, due to the continuous increase of the viscosity. This points to the necessity of considering less stringent conditions (with respect to classical, single-fluid jets) when analytically tackling these flows, and reinforces the idea that viscosity variations must be accounted for when modelling these flows.

**Bio**

**Dr. Danaila** obtained her Bachelor and Master degrees in Mechanical Engineering, at the Polytechnic Institute of Bucharest, Romania and a Master Degree in Fluid Mechanics at the University Aix-Marseilles, Marseilles, France. She obtained her PhD degree in Mechanical Engineering, specialty Fluid Mechanics, at the University Aix-Marseilles, IRPHE Laboratory. Her PhD work was awarded two prizes (of the University Méditerrannée, and of the French Association of Mechanics). Following two years as Associate Professor in Poitiers, where her research was devoted to turbulence in electrochemical devices, she is currently Professor at the University of Rouen, Rouen. Her research deals with turbulent flows and (non-reactive and reactive) mixing, in homogeneous and inhomogeneous fluids (variable density and/or viscosity), using analytical, experimental and numerical approaches. She investigates the role of the initial/boundary conditions and of the flow regime (Reynolds number, injector geometry, coherent motion, etc.) on the flow structure (instabilities, anisotropy, mixing zone), with the aim to model and reliably predict statistics. Her research is supported by the French Research Government, ANR (National Research Agency), The Normandy Region, The Labex (Excellence Laboratory) EMC3, as well as Snecma/Safran. She is a Conjoint Professor at the University of Newcastle, Australia and serves as the chair of the French National Research Group in Turbulence.

## Monday, Mar 28, 2016
## Livermore Center 101 | 2:00 – 3:00 pm