Mon, November 9, 2:30pm – 3:30pm
DIMEAS, sala Ferrari - II piano, Politecnico di Torino.

Reduced Order Models in Turbomachinery

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Abstract:
A general overview of my research will be provided first. Then we will focus on methods to construct lean and accurate models of turbomachinery. Improved aeromechanical models for aggressive lightweight blade design are key to enable high efficiency, environmentally friendly aero engines with maintained safety. Efficient engines use fewer components, have more aggressive operating conditions, and consequently bear greater loads. This poses several modeling challenges. Deviations to cyclic symmetry of blisks (i.e., mistuning) are common due to manufacturing, repairs or foreign object damage. These can lead to dramatically increased forced response through mode localization. In addition, turbomachinery have multiple stages and sometimes use friction dampers. The effects of mistuning, dampers and multiple stages also combine with the aerodynamics. The resulting high computational cost associated with predictions for such complex dynamics can benefit from reduced order modeling techniques. We will discuss such lean and accurate techniques which deal with large and small mistuning, and multi-stage structural coupling. Also, we will discuss a methodology to explore the effects of the aerodynamics on the multi-stage forced response.

Bio:
Bogdan I. Epureanu is a Professor of mechanical engineering at the University of Michigan. He received his Ph.D. from Duke University in 1999. His research blends theories in nonlinear dynamics, structural health monitoring, aeroelasticity and computational dynamics, with applications relevant to aerospace structures, sensors, turbomachinery, and biological systems. In particular, Professor Epureanu develops reduced order models of complex structures, system identification and control methodologies for structures and fluid-structural systems, and the next generation of highly-sensitive structural health monitoring techniques. He has earned several awards, including the 2004 American Academy of Mechanics Junior Achievement Award, an NSF Career Award in 2004, the 2003 ASME/Pi Tau Sigma Gold Medal Award, the 2001 Young Innovator Award from Petro-Canada, and the 2005 Beer & Johnston Outstanding Mechanics Educator Award by the American Society for Engineering Education.