MECHANICAL ENGINEERING **SEMINAR**

"Nonlinear Structural Dynamics in Turbomachinery"

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Abstract: Turbo-machines have wide application ranging from aircraft engines, power generation turbines to reciprocating engine turbochargers and oil & gas equipment. This talk will briefly cover the operating principles of a few different type of turbo-machines followed by a more detailed treatment of heavy duty gas turbines. Design tradeoffs between aero, thermal and structural domains for the hot gas path sections of the turbine will be briefly discussed. The second half of the talk will focus on emerging trends in the areas of aeromechanics and vibrations of turbine blades. The critical role of friction damping in mitigating forced response and flutter risk in aft-stage turbine blades will be highlighted. The computational cost of analyzing nonlinear friction dynamics with commercial FEA tools proves prohibitive for almost all practical applications. Such analysis can be done using reduced order modeling techniques in conjunction with efficient solvers working on the principle of harmonic balance. These state-of-the-art modeling techniques will be presented along with observed effects typical of nonlinear systems such as skewed frequency response curves and presence of multiple solution branches.

Bio: Dr. Suryarghya (Surya) Chakrabarti is a Lead Mechanical Engineer in the Vibrations Lab at GE Global Research since 2012. He specializes in the areas of aeromechanics and structural dynamics of turbomachinery hot gas path components and provides technical support in these areas to various GE businesses (Aviation, Power Generation, Oil & Gas). In particular, his research is focused on developing efficient modeling techniques for analyzing the dynamics of friction damped turbomachinery structures. Prior to GE, he was a structural analysis engineer at Cummins, where he was responsible for dynamic analysis and testing of rotating engine components. Surya received his undergraduate degree from the Indian Institute of Technology in 2007 and his PhD in mechanical engineering from the Ohio State University in 2011. His doctoral research was focused on active magnetostrictive alloys and their application to dynamic actuation and sensing for vibration mitigation. He has authored over 15 technical publications in international journals and conferences and has 1 filed patent (pending).

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