

Uncertainty propagation in structural dynamics: Physics based methods

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Abstract: Propagation of uncertainties in complex engineering dynamical systems is receiving increasing attention. When uncertainties are taken into account, the equations of motion of dynamical systems can be expressed by differential equations with stochastic coefficients. The computational cost for the solution of such systems mainly depends on the number of degrees of freedom and number of random variables. Among various numerical methods developed for such systems, response surface based methods (e. g., polynomial chaos) show significant promise because it is more accurate compared to the classical perturbation based methods and computationally more efficient compared to the Monte Carlo simulation based methods. However, these approaches are inherently 'numerical' in nature and may not always give the physical intuition generally available for a deterministic problem. In this talk, single and multiple degrees of freedom stochastic systems will be considered using a new physics based approach. The main motivation is to use natural frequencies and vibration mode shapes of the underlying deterministic dynamic system to represent the stochastic response characteristics. In this way, it would be possible to understand stochastic dynamical systems in the light of conventional modal properties of a deterministic system, which are already well understood.

Short Bio: Prof Adhikari is the chair of Aerospace Engineering in the College of Engineering of Swansea University. Currently he is a Wolfson Research Merit Award holder from the Royal Society. He received his PhD in 2001 from the University of Cambridge (in Trinity College). He was an Engineering and Physical Science Research Council (EPSRC) Advanced Research Fellow and winner of the Philip Leverhulme Prize (2007). He was a lecturer at the Bristol University and a Junior Research Fellow in Fitzwilliam College, Cambridge. He was a visiting Professor at the Carleton University, University of Johannesburg and a visiting scientist at the Los Alamos National Laboratory. His research areas are multidisciplinary in nature and include uncertainty quantification in dynamic systems, computational bio & nanomechanics (nanotubes, graphene, nano-bio sensors), dynamics of complex systems, inverse problems for linear and non-linear dynamics and vibration energy harvesting. He has published more than 170 international journal papers and 100 conference papers in these areas.