

MINI SYMPOSIUM

Advanced Computational Methods for Stochastic Engineering Dynamics

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ABSTRACT

Recent advancements in emerging and transformative technologies necessitate a highly sophisticated modeling of related systems and excitations. As a result, the form of the governing equations has become highly complex from a mathematics perspective. Irrespective of the scale of the problem (nano- to macro-), examples of sophisticated modeling include fractional calculus, hysteresis and complex nonlinearities, as well as joint time-frequency representations of the stochastic environment/excitation. In many cases, even the deterministic solution of such equations is an open issue and an active research topic. Clearly, solving the stochastic counterparts of these equations becomes significantly more challenging. Nevertheless, the development of novel mathematical tools and of potent signal processing techniques, the ever-increasing available computational capabilities, and advanced experimental setups offer a unique novel tool for addressing complex problems for the first time and even posing new questions.

The objective of this MS is to present recent advances and emerging cross-disciplinary approaches in the broad field of numerical methods for stochastic engineering dynamics with a focus on uncertainty modeling, and propagation. Further, this MS intends to provide a forum for a fruitful exchange of ideas and interaction among diverse technical and scientific disciplines. Specific contributions related both to fundamental research and to engineering applications of computational stochastic dynamics and signal processing methodologies are welcome. A non-exhaustive list includes joint time/space-frequency analysis tools, spectral analysis/estimation subject to highly incomplete/sparse data, stochastic/fractional calculus modeling and applications, nonlinear stochastic dynamics, stochastic stability and control theory, multi-scale/multi-physics stochastic modeling and analysis, stochastic model/dimension reduction techniques, Monte Carlo simulation methods, and risk/reliability assessment applications.