Finite nonlinear responses of uncertain shell structures under non-stationary random excitations

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Presently, various common approaches in dealing with engineering systems that contain uncertain parameters are essentially based on probabilistic models, partially or entirely employing the Monte Carlo Simulation (MCS) and hierarchical uncertainty quantification applying Bayesian inference. Another common category of approaches involves application of perturbation approximation techniques, such as the so-called Stochastic Finite Element Method (SFEM) and Probabilistic Finite Element Method (PFEM). Many of these approaches can only deal with systems with small uncertainties or variations of system parameters and properties. The investigation reported here is concerned with two main objectives. The first main objective is the development of an approach that is capable of providing finite responses of shell structures with large uncertainties and under non-stationary random excitations. The latter are encountered during, for example, the re-entry of space shuttles, and the launching of high power rockets with heavy and expensive payloads. The present approach consists of the FEM and the Stochastic Central Difference (SCD) method that was previously developed by the author and his associates. The second main objective is the study of the difference between finite random responses of shell structures with small and large uncertain properties. For tractability and readily available results for comparison, the nonlinear shell structure studied by the author (2009) is employed in the present investigation. It should be emphasized that in the present investigation the nonlinear spherical cap is hinged circumferentially. Large uncertainties in modulus of elasticity and thickness of the shell structure are included in the present investigation.

Biography
Cho W Solomon To has obtained his Doctoral degree in Sound and Vibration Studies from the University of Southampton in 1980. He is currently a Fellow of the American Society of Mechanical Engineers and a Professor in the Department of Mechanical and Materials Engineering at the University of Nebraska-Lincoln (UNL). Between 1982 and 1992, he was a University Research Fellow of the Natural Sciences and Engineering Research Council of Canada. He has over 300 technical publications which includes 5 books and over 100 refereed international journal papers in the areas of nonlinear random vibration, nonlinear finite element method and nonlinear stochastic control.

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