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Reduction of Stochastic Duffing Equation with Frequency Drift
JASON YALIM, BRUNO D. WELFERT, JUAN M. LOPEZ, Arizona State University — The statistical response of a periodically forced spring-mass system with cubic stiffness and Brownian frequency drift is numerically analyzed using a stochastic reduction. The spring-mass system is subject to a constant, small positive damping and a slow-pass linear frequency ramping for various cubic stiffness values including cases where unbounded solutions can occur for certain initial conditions. The stochastic reduction calculations are compared to corresponding Monte Carlo simulations and it is shown that the ensemble will converge to the stochastic reduction results for given nontrivial Brownian tuning parameters σ. Due to the construction of the reduction, the numerical integration is deterministic which provides a relatively cheap way to approximate the behavior of the stochastic system. The results also provide guidance on how to reduced a stochastic partial differential equation system.

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