TITLE: A proposed stochastic finite difference approach based on homogenous chaos expansion

REFERENCE: Galal, Osama H. "A proposed stochastic finite difference approach based on homogenous chaos expansion." Journal of Applied Mathematics 2013 (2013), doi.org/10.1155/2013/950469.

NUMBER OF AUTHORS: 1

PUBLISHER: Hindawi

YEAR OF PUBLICATION: July, 2013

VENUE: London-Cairo and Global

REFERREING: INTERNATIONAL

IMPACT FACTOR: 0.720 (2013) (Q3-Q4)

ABSTRACT:

This paper proposes a stochastic finite difference approach; based on homogenous chaos expansion (SFDHC).The said approach can handle time dependent nonlinear as well as linear systems with deterministic or stochastic initial and boundary conditions. In this approach, included stochastic parameters are modeled as second-order stochastic processes and are expanded using Karhunen-Loeve expansion, while the response function is approximated using homogenous chaos expansion. Galerkin projection is used in converting the original stochastic partial differential equation (PDE) into a set of coupled deterministic partial differential equations and then solved using finite difference method. Two well-known equations were used for efficiency validation of the method proposed. First one being the linear diffusion equation with stochastic parameter and the second is the nonlinear Burger's equation with stochastic parameter and stochastic initial and boundary conditions. In both of these examples, the probability distribution function of the response manifested close conformity to the results obtained from Monte Carlo simulation with optimized computational cost.