Uncertainty Quantification of Physical Systems with Random Field/Process Input

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Uncertainty of spatial and/or temporal variations widely presents in natural and engineering systems. Quantification of such random field/process input propagating through a system typically involves n-fold convolution of Green's function, e.g. nonlinear oscillation, diffusion or settlement of an inhomogeneous medium, wave scattering of continuum and quantum mechanics, etc. In [3], the idea of orthogonal expansion of a random process/field [2] is generalized to the n-th order convolved orthogonal expansion (COE) especially in dealing with random processes in time domain. Based on [1,2] and the variational framework on stochastic finite elements [1], in this talk some fundamentals of the random field/process based UQ are presented, with examples of application given on random media geomechanics and nonlinear stochastic dynamics.

Keywords: Random field, Random process, Orthogonal expansion, Green function,

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