A variability response functions-based adaptive spectral stochastic finite element method

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The majority of research work in the field of stochastic structural systems has focused on developing various stochastic finite element methodologies. In Galerkin-based methods the system response is spanned by a set of polynomials of the basic random variables. The polynomial chaos coefficients are consequently calculated from the solution of a system of linear equations representing the set of coupled deterministic PDEs defined in the above mentioned tensor product space. A methodology is proposed in this paper for building an adaptive sparse polynomial chaos (PC) expansion of the response of stochastic systems which results to an enhancement of the computational efficiency of the spectral stochastic finite element method (SSFEM). The proposed methodology utilizes the concept of variability response function (VRF) in order to estimate the spatial distribution of the second-order error of the response, as a function of the number of terms used in the truncated Karhunen-Loeve (KL) series representation.

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