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M. M. KAMINSKI 2002 *Journal of Sound and Vibration* **251**, 651–670. Stochastic perturbation approach to engineering structures vibrations by the finite difference method.

The generalized nth order partial differential perturbation-based equation of motion can be proposed as

$$\sum_{k=0}^{n}\binom{n}{k}M^{,n-k}(b^0(x;\theta))\ddot{u}^{,k}(b^0(x;\theta);T)+\sum_{k=0}^{n}\binom{n}{k}C^{,n-k}(b^0(x;\theta))\dot{u}^{,k}(b^0(x;\theta);T)$$
$$+\sum_{k=0}^{n}\binom{n}{k}K^{,n-k}(b^0(x;\theta))u^{,k}(b^0(x;\theta);T)=f^{,n}(b^0(x;\theta);T),$$

where the operators $M^{,n}$, $C^{,n}$, $K^{,n}$ denote the nth order partial derivatives of mass, damping and stiffness matrices with respect to the input random variables determined at the expected values of these variables, respectively. The vectors $f^{,n}(b^0;T)$, $\ddot{u}^{,n}(b^0;T)$, $\dot{u}^{,n}(b^0;T)$, $u^{,n}(b^0;T)$ represent analogous nth order partial derivatives of external excitation, accelerations, velocities as well as displacements of the system. Let us note that the stochastic hierarchical equations of motion for a desired perturbation order "m" can be obtained from equation (10) by successive expansion and substitution of "n" by the natural numbers 0,1,…,m that returns the system of $(m+1)$ equations. Then, the zeroth order solution is obtained from the first equation; then, inserting the zeroth order solution into the second equation (of the first order), the first order solution can be deterimed. The analogous procedure is repeated to determine all orders of the structural response, which are finally used in the calculation of the response probabilistic moments.

Let us note that detailed computational studies should be performed further to determine the perturbation order necessary to achieve the satisfactory convergence of the results with respect to the perturbation parameter ε and the coefficients of variation of the input random variables.

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