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Evaluation of dynamic loads for stochastic structures based on matrix perturbation and shape function method

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Based on the matrix perturbation theory and shape function method, an analysis method is proposed to identify the dynamic loads for stochastic structures. The dynamic loads are expressed as convolution integral functions of time and random parameters. Through the discretization of convolution integral, the first-order matrix perturbation on the basis of Taylor expansion is used to transform the problem of load identification for stochastic structures into two kinds of certain inverse problems, namely the dynamic load identification on the mean value of structures' random parameters and the sensitivity identification of dynamic loads to each random parameter. For these determinate problems, the shape function method is proposed to overcome ill-posedness of the inverse identifications. Then the modified regularization operator and L-curve method are adopted to obtain stable and approximate solutions of certain inverse problems and valid assessments of statistics of identified loads. Numerical simulation demonstrates that aimed at stochastic structures, the identification and assessment of dynamic loads are achieved stably and effectively by the present method.

Keywords: Load identification, Stochastic structures, Perturbation theory, Shape function method, Inverse problem