Design Sensitivity Analysis of Nonstationary Random Vibration

Taicong CHEN, *Cheng SU, Zhiqiang HU, Haitao MA

State Key Laboratory of Subtropical Building Science, School of Civil Engineering and Transportation, South China University of Technology, China

*Corresponding author: cvchsu@scut.edu.cn

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A new design sensitivity analysis algorithm is presented for structures under nonstationary dynamic loadings. Taking a new time domain approach to the nonstationary random vibration analysis, a highly efficient scheme is developed for the sensitivities of first and second moments of structural responses with respect to a design parameter. The algorithm is based on the precise integration of dynamic equations in terms of state variables. Two deterministic transient dynamic analyses are required to get the coefficient matrices for the calculation of sensitivity results. Sensitivity analysis of a frame structure subjected to earthquake excitation with Tajimi-Kanai's power spectrum is presented, and numerical results are compared with those obtained using Monte-Carlo simulation and the Pseudo Excitation method, showing the accuracy and efficiency of the proposed method.