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Passive vibration control of beams subjected to random excitations with peaked PSD

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Abstract

Vibration suppression in beams subjected to random excitations with peaked Power Spectral Densities (PSDs) is studied in this paper. An optimal Tuned Mass Damper (TMD) system is used to suppress the undesirable vibration. The Timoshenko beam theory is applied to the beam model and the governing equations of motion are solved using the Galerkin method. Using the Sequential Quadratic Programming (SQP) method, the problem is solved to obtain the optimum values of the design variables (i.e. frequency ratio and the damping ratio) of the TMD system. Subsequently, a parametric study is carried out and the effects of the input parameters, such as the mass ratio, structural damping ratio, and the peak frequency of the random excitation on the design variables were investigated. The robustness of the optimal control system is also studied. Based on the PSD of the random excitation and using a Monte Carlo simulation algorithm, a set of numerical data for the excitation force is generated in the time domain and the effectiveness of the designed TMD system is investigated. © 2006 SAGE Publications.

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Engineering main heading: Vibration control

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