

Control of kinetic energy of a one-dimensional structure using multiple vibration neutralizers

Abstract

There are two cases presented in this paper: the effects of multiple vibration neutralizers on the kinetic energy of a continuous structure, all tuned to a particular natural frequency, and when the tuning ratio of each neutralizer is optimally adjusted at each excitation frequency using quadratic minimization technique. In the first case, theoretical formulations are developed to calculate the width of the separation between the new resonances and the kinetic energy reduction. The width between the new resonances is found to be a function of the total mass of the neutralizers and the modal amplitudes at the neutralizer's location, whereas the kinetic energy reduction is determined by their total damping ratios, total mass and also the modal amplitudes at their respective locations. In the second case, it is found that the reduction of the kinetic energy in the frequency range of interest increases with the number of optimally detuned neutralizers, and the reduction is comparable to that of the feedforward active control method. Simulations are presented to facilitate better understanding on the control effects using multiple vibration neutralizers.