Quasi-Analytical Shock Response Spectra, for Proportionally Damped Systems, with Remote Shock Loading

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ABSTRACT:

Recently, exact linear equations were presented for the time-domain response of an MSD system to a local input (i.e., directly applied, seismically, to the MSD system), comprising exponentially decaying sinusoids. It was noted in that work that such an input could be the result of a remote shock consisting of an ideal impulse, as filtered through the eigensystem comprising the linear model of a structure. The present research is a continuation of that initial effort. In the present paper the analytical time response, of the (hypothetical) MSD system used for SRS determination, is determined for a remote shock input of three forms: an ideal impulse, a rectangular pulse, and a saw-tooth pulse. Having these analytical expressions for the kinematic quantities underlying the various SRS's permits the SRS's to be computed exactly for these remote shock inputs, to a linear system (assuming knowledge of the system's eigenstructure), without necessitating numerical evaluation of a convolution integral. The equations can be used as a benchmark to evaluate the accuracy of other methods of SRS determination. They can also be used to determine the minimum number of modes required, in a system's finite-element model, to produce an SRS of specified accuracy.

KEY WORDS: Shock, Shock Response Spectrum, Vibration, SRS

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