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Abstract

A novel type of a nonlinear energy sink is proposed by introducing a lever to reduce the necessary mass. The lever-type nonlinear energy sink is attached to a two-degree-of-freedom simplified model of whole-spacecraft subjected a harmonic excitation. The transmissibility is used to evaluate the performance of vibration reduction. The harmonic balance method with an alternating frequency time is applied to predict the variation of the transmissibility with the excitation frequency. The harmonic balance solutions are supported by the numerical results. It is found that the disappearance of closed detached resonance response may dramatically decrease the transmissibility. Besides, the quasi-periodic motion may be a predictor to generate the closed detached resonance. The harmonic balance solutions are used to examine the effects of the mass, the nonlinear stiffness and the fulcrum location. With a suitable fulcrum location, the lever-type nonlinear energy sink outperform a conventional nonlinear energy sink with same mass, damping and nonlinear stiffness.

Keywords: Transmissibility; Nonlinear energy sink; Harmonic balance method; HBM-AFT; Lever-type nonlinear energy sink; LNES

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