

Investigation of Shear Thickening Fluid Isolator with Vibration Isolation Performance

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Abstract : According to the theory of the vibration isolation for linear systems, linear damping can reduce the transmissibility at the resonant frequency, but inescapably increase the transmissibility of the isolation frequency region. To resolve this problem, nonlinear vibration isolation technology has recently received increasing attentions. Shear thickening fluid (STF) is a special colloidal material. When STF is subject to high shear rate, its rheological property changes from a flowable behavior into a rigid behavior, i.e., it presents shear thickening effect. STF isolator is a vibration isolator using STF as working material. Because of shear thickening effect, STF isolator is a variable-damped isolator. It exhibits small damping under high vibration frequency and strong damping at resonance frequency due to shearing rate increasing. So its special inherent character is very favorable for vibration isolation, especially for restraining resonance. In this paper, firstly, STF was prepared by dispersing nano-particles of silica into polyethylene glycol 200 fluid, followed by rheological properties test. After that, an STF isolator was designed. The vibration isolation system supported by STF isolator was modeled, and the numerical simulation was conducted to study the vibration isolation properties of STF. And finally, the effect factors on vibrations isolation performance was also researched quantitatively. The research suggests that owing to its variable damping, STF vibration isolator can effectively restrain resonance without bringing unfavorable effect at high frequency, which meets the need of ideal damping properties and resolves the problem of traditional isolators.

Keywords : shear thickening fluid, variable-damped isolator, vibration isolation, restrain resonance

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