Design of a vibration isolator based on magnetorheological elastomers

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Abstract

Magnetoactive elastomers (MAE) are smart materials composed of an elastomer matrix and ferromagnetic particles with field-dependant mechanical properties. MAEs synthetized with magnetically hard NdFeB particles allow for field-induced deformation also known as magnetostriction. On the other hand, composites with soft carbonyl iron particles exhibit field-dependant elastic moduli and damping, referred as magnetorheological elastomers (MRE). The instant and reversible magneto-mechanical response of MREs is leveraged to develop an adaptative vibration isolator to control a single degree of freedom. The designed device features MREs separately excited in shear and compression modes in order to achieve a greater range of magnetorheological effect while ensuring load bearing capacity. The real-time stiffness and damping of the isolator are controlled by the input current in the coil. Current research includes the fabrication of the composites, the design of isolators, the experimental results and introduces the various modeling approaches for MAE-based devices.

Keywords

Vibratory Control, Magneto-Active Materials, Numerical and Experimental Design