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Self-powered Smart Damping System Using MR Damper

Hyung-Jo Jung, Dong-Doo Jang, Heon-Jae Lee

Summary

A recently developed self-powered smart damping system consists of a magnetorheological (MR) damper and an electromagnetic induction (EMI) part. An EMI part generates current from vibration of a structure according to Faradaya?Ts law of electromagnetic induction so that it directly provides a relative velocity-dependent current input for an MR damper to change the damping characteristics. Hence, a feedback control part consisting of sensors, a controller and a power supply in a conventional semiactive control system can be replaced with an EMI part in this system. The control performance of the self-powered smart damping system has been demonstrated mainly by numerical simulations in the cases of civil engineering structures such as buildings and bridges. On the other hand, the experimental validation of the system is not sufficiently conducted yet. In this paper, the feasibility of the self-powered smart damping system to real-scale structures is thoroughly investigated. To do this, the large-scale self-powered smart damping system is designed, manufactured, and tested. Its applicability to large real-scale structures is examined through a series of shaking table tests. According to the test results, the large-scale EMI part could generate the sufficient current or power for changing the damping characteristics of the large-capacity MR damper without any difficulty. Therefore, the large-scale self-powered smart damping system could be considered as one promising control devices for civil engineering applications.