

# Seismic isolators of variable stiffness for earthquakes with strong long-period components

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## ABSTRACT

It has been proven that seismic isolation is an effective technology for the seismic protection of structures and equipment. Nevertheless, because a structure with conventional seismic isolators is usually a long-period structural system, recent studies have revealed that the conventional isolation system may suffer the problem of excessive isolator displacements when subjected to a near-fault ground motion that usually contains strong long-period components. In order to overcome such a problem, a functionally upgraded seismic isolator of variable stiffness (SIVS) is introduced, and its isolation performance in long-period ground motions is investigated. Through the predetermined geometric condition, the isolation stiffness of the SIVS is a function of the isolator displacement. As shown in Figure 1, the isolator is designed in a way that the stiffness of the SIVS has a softening behavior followed by a hardening behavior, when the isolator moves away from its neutral position. The softening and hardening behaviors aim to reduce the structural acceleration and isolator drift, respectively. In order to verify the feasibility of the SIVS concept, a shaking table test on prototype SIVS isolators was conducted (see Figure 2). The result of the shaking table test demonstrates that when subjected to an earthquake with a long-period pulse component, the SIVS system is able to effectively suppress the maximum isolator drift, without causing the amplification of the structural acceleration.

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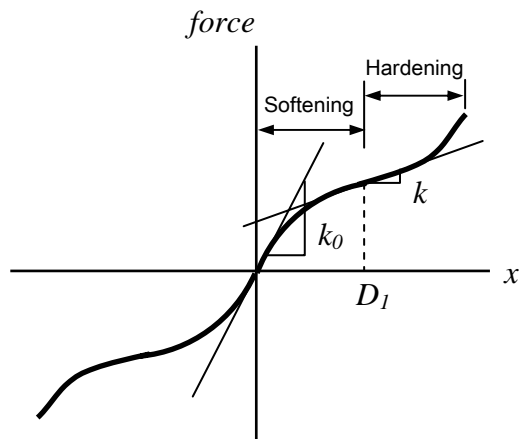


Figure 1 Force-displacement relation of the SIVS.

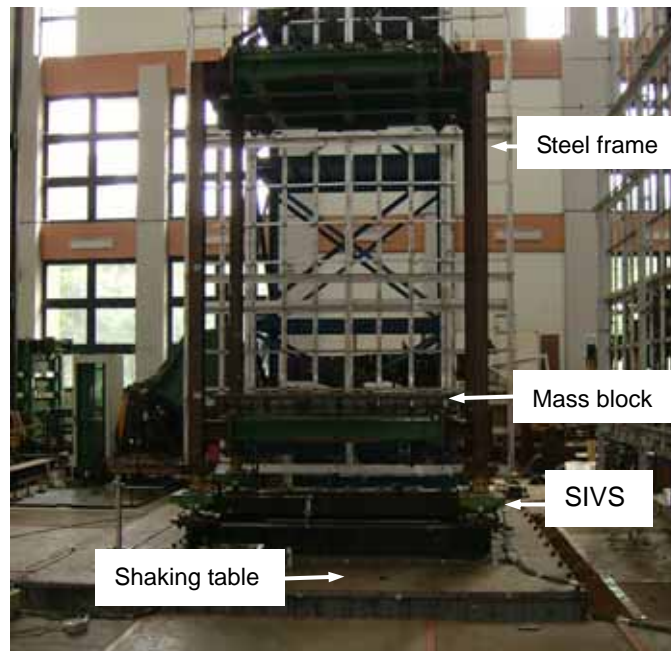


Figure 2 Test setup of the shaking table test.