BEHAVIOR OFSLIDING ISOLATORS WITHVARIABLE FRICTIONUNDER NEAR-FAULTEARTHQUAKES

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ABSTRACT

One of the ways to make FPS adaptable is to make its friction coefficient variable.For a sliding isolator with variable friction (SIVF), the sliding surface may have a constant radius, but the friction coefficient of the isolator is assumed to be a function of the isolator displacement which results in adaptive damping that varies along the isolator displacement.Variable Friction Pendulum System (VFPS) is a kind of SIVF isolator whichis very similar to FPS except that the friction coefficient of FPS is considered to be constant whereas the friction coefficient of VFPS is variedin the form of a curve. However, suchavariation of coefficient of friction is difficult and impractical to be achieved in the real world.The present studyintroduces an alternative isolator, namely, Modified Variable Friction Pendulum System (M-VFPS) with a very simple and practical variation of coefficient of friction. To compare the responses of the two isolators, an idealized 2-DOF shear building with an isolation system modeled by a nonlinear friction element and a variable spring element is simulated by using a general mathematical model. Moreover, a set of seven near-fault earthquake excitations are considered for evaluation purposes with two main aspects governing effectiveness of isolator: (1) base displacement and (2) super-structural acceleration. The results indicate that the seismic behavior of M-VFPS is close to that of VFPS and, thus, it can be considered as an alternative. In addition, in comparison to a conventional FPS isolator, both M-VFPS and VFPS show better behavior in reduction of base displacement while they are not so successful in controlling of the acceleration transmitted to the super-structure.

INTRODUCTION

Seismic base isolation has been used with increasing popularity to protect structures, together with their occupants, secondary systems and internal equipment, from the damaging effects of earthquakes. Seismic isolation is indeed an approach to reduce transmitted earthquake forces to the super-structure by shifting the fundamental period of structure away from the predominant frequencies of ground excitation and minimize the structural damage as a result (Soni D. P. *et al.* 2011).

Among many different types of isolators, friction pendulum system (FPS) is a sliding isolator with a simple geometry that incorporates both energy dissipation and re-centering mechanism into one single unit (Zayas Victor A *et al.* 1987). The effectiveness of FPS isolator has been widely investigated both analytically and experimentally,and it has been found suitable for many different structures and excitation characteristics(Mokha Anoop *et al.* 1991, Tsai CS 1997, Almazán José L *et al.* 1998). The sliding surface of a FPS isolator is made spherical, so that the gravitational load of the structure applied on the slider will provide a restoring stiffness that help reduce residual isolator displacement.However, this restoring stiffness,