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INFLUENCE OF THE STRENGTH REDUCTION FACTOR ON THE SEISMIC RELIABILITY OF STRUCTURES WITH FPS CONSIDERING INTERMEDIATE PGA/PGV RATIOS

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Abstract

This paper deals with seismic reliability of nonlinear structural systems equipped with friction pendulum isolators (FPS), subjected to different natural seismic records with intermediate PGA/PGV ratios. The isolated system is described by a 2DOF system and the FPS behavior is described by employing a velocity dependent model. The friction coefficient at large velocity is considered as a random variable. Employing a set of natural seismic records having intermediate PGA/PGV ratios and scaled to the seismic intensity corresponding to life safety limit state for L'Aquila site (Italy) according to NTC08, the inelastic characteristics of the superstructures are designed by evaluating the ratio between the average elastic responses and increasing strength reduction factors. Incremental Dynamic Analyses (IDA) are developed to evaluate the seismic fragility of both the superstructure and the isolation system assuming different values of the corresponding limit states. Integrating the fragility curves with the seismic hazard curve related to L'Aquila site (Italy), the reliability curves of the inelastic base-isolated structural systems, with a design life of 50 years, are derived.

Keywords: seismic isolation; friction coefficient; seismic reliability; PGA/PGV ratio; strength reduction factor; numerical analysis; statistical properties.

1. INTRODUCTION

In last decades, friction pendulum system (FPS) [1]-[2] has emerged as a very effective technique for the protection of building frames which, even if designed according to the most advanced codes, could suffer severe damages under strong earthquake events [3]. Over the years, within the issues of the passive control of structures, new isolation devices made of composites or magnetorheological elastomers [4]-[5] have been developed as well as many works have proposed new design strategies