

## **ABSTRACT**

The thesis investigates the seismic reliability of isolated structures with FPBs (Friction Pendulum Bearings) towards failure due to high vertical component excitation and friction coefficient variations. In the end, it has been studied the influence of the uncertainty of the input excitation on the vulnerability of complex structures such as viaducts in the case of different seismic isolation strategies application.

The last seismic events (Christchurch 2011, L'Aquila 2009) have highlighted lacks in the actual design philosophies (PBD) due to the high structural damage experimented by structures.

The Passive Control Technique of seismic response allows high structural performances respect to the one of fixed base structures, in this way making sustainable the repairing costs of structures in the case of medium high intensity seismic event.

After introducing a rich bibliography on mathematical theory of base isolated structures, with some remarks on the state space formulation which allow to carry out modal analysis of non classically damped structures such as the one object of the study, on the mechanical and dynamical behavior of Friction Pendulum System device and on the current Technical Code in Italy (NTC08), it has been introduced the theme to be investigated.

Being the FPS behavior related to the friction force, the seismic response can be affected by particular seismic event as near fault event characterized by high vertical component intensity of seismic excitation. Moreover the degradation of the sliding interface due to velocity, pressure and temperature variations can influence the seismic response of the device.

To the scope of investigating the collapse phenomenon of the device, non linear dynamic analysis have been carried out through deterministic parametric methods with different near fault input excitations, on two different systems: the first described by a rigid superstructure and isolation system described by the Nagarajaiah model (1990), the second representative of a benchmark r.c. building of four levels (Almazan 2003).

The subsequent stochastic analysis carried out by means of the use of Montecarlo simulation, taking advantage of the inversion method, on a system described by rigid superstructure and isolation system described by a rigid-plastic behavior with hardening, have highlighted the relation between the stochastic response and the uncertainty of the friction coefficient in the case of sinusoidal excitation.

Finally, it has been investigated the vulnerability of bridge structures in different isolation system design configurations by using fragility analysis, carried out taking advantage of the Multi Stripes method (Baker 2014). Results show the probability of exceedance of the limit state considered variations taking into account the uncertainty of the input excitation.