# A dynamic analysis of base isolated structures subject to strong dynamic loadings

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### Abstract

In the present work an innovative base isolation device is analyzed and studied. The analyzed base isolation device is called high damping hybrid seismic isolator (HDHSI). It is obtained by the assembly in series of a lead rubber bearing isolator (LRB) and a friction slider isolator (FS) characterized by a high friction coefficient. This base isolation system is designed in compliance with the European seismic codes EC2 and EC8. The base isolation device can be used in the passive control of solids and structures and the base isolation for the earthquake resistance of structures. In the present study the dynamic response of a multi-storey structure base isolated by the proposed isolation system is analyzed and compared with the dynamic response of the same structure base isolated by a classical lead rubber bearing isolators (LRB). Accordingly, the analyzed HDHSI base isolation system is compared to a traditional LRB base isolation system for the protection of structures under extreme dynamic loadings. A nonlinear dynamic analysis is performed for the base isolated structure. In the analysis different extreme dynamic events have been considered. The considered dynamic events are characterized by extreme values of peak ground acceleration and frequency content. Accordingly, the considered dynamic events are characterized by anomalous values of intensity and frequency content. The reported nonlinear analysis studies the multi-storey structure base isolated by the considered HDHSI system. The time history of the base shear and the time history of the base displacement are investigated for the structure subject to the considered extreme dynamic events. Consequently, the outlines of the analyzed base isolation system are shown for the protection of structure under extreme dynamic events.

#### Keywords: Dynamic nonlinear analysis, Base isolation systems, Strong seismic events.

#### References

- [1] EC2, Eurocode 2: Design of concrete structures, UNI EN 1992-1-1, European Committee for Standardization, CEN/TC 250, (2004).
- [2] EC8, Eurocode 8: Design of Structures for Earthquake Resistance Part 1: General rules, seismic actions and rules for buildings, PrEN1998-1, European Committee for Standardization, TC250/SC8, (2003).
- [3] Cancellara, D., De Angelis, F., A base isolation system for structures subject to extreme seismic events characterized by anomalous values of intensity and frequency content, Composite Structures, Vol. 157, pp. 285–302, (2016).
- [4] Cancellara, D., De Angelis, F., Assessment and dynamic nonlinear analysis of different base isolation systems for a multi-storey RC building irregular in plan, Computers and Structures, Vol. 180, pp. 74–88, February (2017).
- [5] Cancellara, D., De Angelis, F., Nonlinear dynamic analysis for multi-storey RC structures with hybrid base isolation systems in presence of bi-directional ground motions, Composite Structures, Vol. 154, pp. 464– 492, (2016).