6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

STATISTICAL MODELLING OF HDNR BEARING PROPERTIES VARIABILITY FOR THE SEIMIC RESPONSE OF ISOLATED STRUCTURES

L. Ragni[1], F. Micozzi[2] and A. Dall'Asta[3]

[1] Università Politecnica delle Marche, via Brecce Bianche Ancona, laura.ragni@univpm.it
[2] Università di Camerino, Viale della Rimembranza Ascoli Piceno, fabio.micozzi@unicam.it
[3] Università di Camerino, Viale della Rimembranza Ascoli Piceno, andrea.dallasta@unicam.it

Key Words: *seismic isolation, HNDR bearings, material uncertainties, supply variability*

This paper reports some results of an ongoing Research Project aimed at computing the risk of collapse of new buildings conforming to the Italian Seismic Design Code and funded by the Italian Civil Protection Department [1]. The project involves different areas of application (reinforced concrete, masonry, steel buildings, etc) including reinforced concrete (RC) buildings equipped with isolation systems. In particular, this paper focuses on seismic isolation systems based on High Damping Natural Rubber (HDNR) bearings, which are widely employed for seismic isolation of buildings and other structures. The aim of the paper is to evaluate the response dispersion due to the uncertainties in the input as well as the variability of the isolation system properties.
The study considered and modelled the variability of the bearing properties due to the supply, taking into account the tolerance allowed in quality control tests [2]. To this purpose, in the first part of the paper, experimental results of groups of specimens belonging to different stocks has been analysed, focusing on nominal values of shear stiffness and damping coefficient at design deformation and their correlation inside and between devices.
Both the intra-class and inter-class variability affecting the HDNR isolator properties are evaluated, by using proper statistical models [3]. Successively, the effect of the quality control tests based on acceptance criteria provided by the European code on anti-seismic devices [2] on the properties variability is evaluated.
In the second part of the paper, results of multi-stripe analyses carried out on a base isolated prototype consisting of a 6-storey RC building are illustrated for different ground motion intensities. In particular, calibrated the statistical model, several varied structural model were sampled starting from the mean property of isolation. The influence of the bearings parameters variability on the most interesting engineering demand parameters (EDPs) controlling the seismic performance as well as the collapse modalities is evaluated and discussed.

REFERENCES

[1] I. Iervolino, A. Spillatura, P. Bazzurro. RINTC Project - Assessing the (implicit) seismic risk of code-conforming structures in Italy. *COMPDYN 2017*, M. Papadrakakis, M. Fragiadakis (eds.) Rhodes Island, Greece, 15–17 June 2017.
[2] European Committee for Standardization. *EN 15129:2010 - Antiseismic devices*, Brussels, Belgium, 2010.
[3] Michael H. Kutner [et al.]. *Applied linear statistical models*.-5th ed. (McGraw-Hill/Irwin series Operations and decision sciences)