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

REALISTIC SEISMIC ASSESSMENT OF RC BUILDINGS WITH MASONRY INFILL USING 3D HIGH-FIDELITY SIMULATIONS

Giuseppe Occhipinti[1], Bassam Izzuddin[2], Lorenzo Macorini[2], Ivo Caliò*[1]

[1]Department of Civil and Environmental Engineering University of Catania Catania, Italy
giuseppe.occhipinti@dica.unict.it, icalio@dica.unict.it
[2]Department of Civil and Environmental Engineering Imperial College London, London SW7 2AZ, UK b.izzuddin@imperial.ac.uk, l.macorini@imperial.ac.uk

Key Words: *3D nonlinear dynamic analysis, seismic assessment of RC building, macromodeling, infilled frame structures, ADAPTIC.*

This paper presents a high fidelity numerical model developed to investigate the seismic performance of a 10-storey reinforced concrete (RC) framed building. The considered structure represents a typical existing RC building in Catania, Italy, and it was designed according to old standards to resist gravity and wind loading but not earthquakes. The proposed numerical description adopts beam-column elements [1] and detailed shell elements [2], both allowing for geometric and material nonlinearity. In order to model the influence of masonry infill, a novel macro-element has been developed within a FE framework based on a discrete formulation proposed in previous research [3]. 3D nonlinear dynamic simulations are performed considering sets of natural accelerograms acting simultaneously along the three spatial directions and selected on the base of the spectrum compatibility at the Near Collapse Limit State (NCLS). To improve computational efficiency the partitioning approach, developed at Imperial College [4], is adopted enabling effective parallelisation on HPC systems. The numerical results obtained from the 3D nonlinear dynamic simulations are presented and discussed considering or neglecting the infill panel contribution. The numerical results confirm the poor seismic performance of the original structure and collapse is predicted for low magnitude seismic events compared to the earthquake expected in Catania. The comparison of the analyses performed with and without nonstructural infill panels show significant variation in the dynamic responses highlighting the need to consider masonry infill contribution for obtaining a realistic modelling of existing RC building structures not designed to resist earthquakes.

REFERENCES

[1] B.A. Izzuddin and D. L. Smith, Efficient Nonlinear Analysis of Elasto-Plastic 3D R/C Frames Using Adaptive Techniques. *Computers & Structures*, Vol. **78**(4), 549-573, 2000.

[2] B.A. Izzuddin, X.Y. Tao, A.Y. Elghazouli, Realistic Modelling of Composite and R/C Floor Slabs under Extreme Loading. *Journal of Structural Engineering*, ASCE, Vol. **130**(12), 1972–1984, 2004.

[3] I. Caliò, B. Pantò, A macro-element modelling approach of Infilled Frame Structures. *Computers and Structures*, Vol. **143**, 91-107, 2014.

[4] G.A. Jokhio, B.A. Izzuddin, A dual super-element domain decomposition approach for parallel nonlinear finite element analysis. *International Journal for Computational Methods in Engineering Science and Mechanics*, Vol. **16**(3), 188-212, 2015,