Numerical Validation of the Experimental Cyclic Response of RC Frames

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Abstract

In this paper is estimated the numerical cyclic response of RC frames with and without masonry infill's through a simplified nonlinear analysis using a commercial finite element method (FEM) package. The numerical model is based on the experiments carried out in the National Laboratory of Civil Engineering (LNEC) and the numerical and experimental results are compared to assess the accuracy of the simplified analysis for the bare frame and for the infill frame. To take into account the highly nonlinear behaviour of reinforced concrete (RC) frames due to large deformations, a numerical model based on the inelastic hinge method is used with a higher complexity of the hinge constitutive laws, which allows verifying the suitability of every hinge model to the experimental results.

Keywords: infill RC frames, cyclic response of RC frames, nonlinear analysis.

1 Introduction

The widespread buildings constructed in Portugal and also in other European countries present a well-known structural solution based in the spatial repetition of masonry infill frames. The damage and collapse of structures of this type, as a result of significant floor lateral deformations induced by moderate to severe seismic events, are nowadays two of the main concerns of the structural designers.
For seismic design a spectral response procedure is normally used allowing the verification of the resistant capacity and serviceability limits. These verifications guarantee the resistant capacity necessary to prevent the structure collapse and enough stiffness to prevent an excessive deformation with the consequent reduction of damage and a better use of the building during the seismic event. In these methodologies the response depends on the structure ductility that involves the reduction of the seismic efforts through ductility coefficients to simulate the nonlinear behaviour when an elastic analysis is implicated in the design.