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Title : Numerical Modelling of Masonry-infilled RC Frame

Abstract:

The behavior of masonry-infilled reinforced concrete (RC) frame structures during an earthquake, has attracted the attention by structural engineers since 1950's. Experimental and analytical studies have been carried out to investigate the performance of masonry-infilled RC frames under in-plane lateral loadings.

My study is to create a numerical model of the behavior of existing masonry-infilled RC frame that was studied experimentally at the University of Patra for a PhD study. The objective of this study was to identify suitable numerical constitutive models of each component of the structural system to create a numerical tool to represent the masonry infill's in-plane behaviour by accounting the frame-infill separation.

In DIANA finite element analysis (FEA) software, a 2D masonry-infilled RC frame was developed and a structural linear, eigenvalue and nonlinear cyclic analysis were performed. It is a 2:3 scale three-story structure with non-seismic design and detailing, subjected to in-plane cyclic loading through displacement control analysis. The proposed meso-model for masonry-infilled RC frame was implemented in DIANA FEA using available materials, sections and elements commands. The material models that were selected for the concrete and steel reinforcement were the Maekawa–Fukuura Concrete Model and Menegotto–Pinto model. In addition the material models that were selected for the masonry infill wall and for the interface between the wall and the RC frame were the New Engineering Masonry model and the Coulomb Friction model respectively.

The numerical model results were compared and represented an agreed correlation to the experimental ones through a cyclic nonlinear analysis. It was found that the numerical model has the capability to predict the initial stiffness, the ultimate stiffness, the maximum shear-force capacity, cracking patters and the possible failure mode of masonry-infilled RC frame.

The study concludes that this model is a reliable model of the behavior of masonry-infilled RC frame including the frame-infill separation (gap opening).