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DEPARTMENT OF CIVIL, COMPUTER AND AERONAUTICAL ENGINEERING
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MSc Course in Civil Engineering for natural risk protection
Laurea Magistrale in ingegneria Civile per la protezione dai rischi naturali

MSc Degree Thesis
Tesi di Laurea Magistrale

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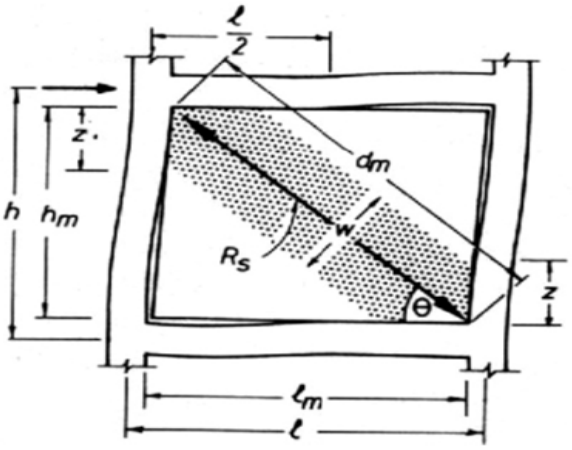
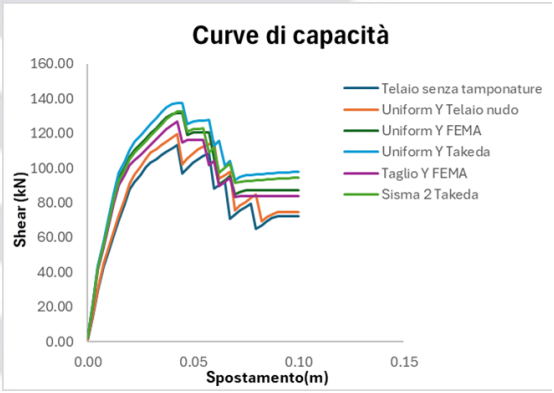
Seismic behavior of a 1970s r.c. frame building

Motivations and aims

In buildings with a reinforced concrete or steel frame, lightweight mortar and brick masonry is used for infill and partition walls. For simplicity and economy, infill panels are often made in direct contact with the structural elements. For this reason, infill panels are considered non-structural elements in the design, with the idea that neglecting their contribution to stiffness and resistance increases the safety. It has therefore been shown that it is of fundamental importance to understand how infill panels interact with the frame and how they modify its structural response during a seismic event.



Methods and results



The infills were modeled in Midas Gen as a pair of equivalent struts, resisting compression only, with a nonlinear force-displacement relationship according to the model proposed by Panagiotakos & Fardis. Pushover and Time-History analyses were conducted, using nonlinear relationships for the plastic hinges of beam and truss elements. By comparing the results obtained from both analyses applying the N2 Method, the seismic response of the structure was estimated.

Conclusions and future developments

The results show that the seismic demand of the Time-History analysis closely resembles that of the Pushover analysis, although they are not completely aligned. The main inaccuracies arise from the Pushover analysis and the determination of the displacement demand. The Pushover analysis assumes a time-independent displacement form, which is inaccurate for structures with significantly higher modes and changing dynamic characteristics. Another inaccuracy arises from the determination of the displacement demand for the equivalent SDOF system, which depends on the chosen period and spectrum. Despite its complexity, the Pushover analysis remains a valuable tool for assessing seismic safety and guiding remedial measures.