Probabilistic Seismic Loss Assessment of Reinforced Concrete (RC) Frame Buildings Pre- and Post-Rehabilitation

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Abstract : This paper considers the seismic assessment and retrofit of a pilotis-type RC frame building, which was designed for gravity loads only, prior to the introduction of seismic design provisions. Pilotis-type RC frame buildings, featuring an uniform infill throughout the height and an open ground floor, were, and still are, quite popular all over the world, as they offer large open areas very suitable for retail space at the ground floor. These architectural advantages, however, are of detriment to the building seismic behavior, as they can determine a soft-storey collapse mechanism. Extensive numerical analyses are carried out to quantify and benchmark the performance of the selected building, both in terms of overall collapse capacity and expected losses. Alternative retrofit strategies are then examined, including: (i) steel jacketing of RC columns and beam-column joints, (ii) steel bracing and (iv) seismic isolation. The Expected Annual Loss (EAL) of the selected case-study building, pre- and post-rehabilitation, is evaluated, following a probabilistic approach. The breakeven time of each solution is computed, comparing the initial cost of the retrofit intervention with expected benefit in terms of EAL reduction.

Keywords : expected annual loss, reinforced concrete buildings, seismic loss assessment, seismic retrofit
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