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Seismic Loss Assessment for Peruvian University Buildings with Simulated Fragility Functions

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Abstract : Peruvian university buildings are critical structures for which very little research about its seismic vulnerability is available. This paper develops a probabilistic methodology that predicts seismic loss for university buildings with simulated fragility functions. Two university buildings located in the city of Cusco were analyzed. Fragility functions were developed considering seismic and structural parameters uncertainty. The fragility functions were generated with the Latin Hypercube technique, an improved Montecarlo-based method, which optimizes the sampling of structural parameters and provides at least 100 reliable samples for every level of seismic demand. Concrete compressive strength, maximum concrete strain and yield stress of the reinforcing steel were considered as the key structural parameters. The seismic demand is defined by synthetic records which are compatible with the elastic Peruvian design spectrum. Acceleration records are scaled based on the peak ground acceleration on rigid soil (PGA) which goes from 0.05g to 1.00g. A total of 2000 structural models were considered to account for both structural and seismic variability. These functions represent the overall building behavior because they give rational information regarding damage ratios for defined levels of seismic demand. The university buildings show an expected Mean Damage Factor of 8.80% and 19.05%, respectively, for the 0.22g-PGA scenario, which was amplified by the soil type coefficient and resulted in 0.26g-PGA. These ratios were computed considering a seismic demand related to 10% of probability of exceedance in 50 years which is a requirement in the Peruvian seismic code. These results show an acceptable seismic performance for both buildings.

Keywords : fragility functions, university buildings, loss assessment, Montecarlo simulation, latin hypercube
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