Possibility-based fragility curves for seismic damage data

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Fragility curves have been used in earthquake engineering to assess the probability of exceeding a specific damage state according to the magnitude of earthquake. Considering that the damage states for fragility curves are generally nested to each other, the possibility theory, a special form of the evidence theory for nested intervals, is applied to generate fragility information from seismic damage data. While the lognormal distributions are conventionally used to generate fragility curves due to its simplicity and applicability, the methodology to use the possibility theory does not require the assumption of distributions. Seismic damage data classified by three damage levels was used for a case study. The resulted possibility-based fragility information expressed by two monotone measures, "possibility" and "certainty", are compared with the conventional fragility curves. The results showed that the conventional fragility curves provide a conservative estimate for the probability of high damage, while underestimate the probability of slight damage.

Keywords: Earthquake engineering, seismic data ,fragility curves, possibility theory