Global fragility assessments considering uncertainties in response threshold

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ABSTRACT
A multi-dimensional definition of fragility is developed considering multiple variables such as floor acceleration and interstory drifts. The limit states which have uncertainties are defined as random variables in the calculation of fragility. A random description of the limit state has been adopted to calculate fragility.

A generalized formula for multidimensional threshold of limit states has been proposed and different cases have been considered as particular cases of the main general case. The procedure of evaluation fragility was programmed and implemented in a pre and post processor for IDARC2D, an inelastic analysis program.

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BACKGROUND
Southern California has been considered to show the applicability of this technique. The development of fragility for different cases show how important a correct evaluation of the limit state is for comparison of different techniques. The MCEER series and SAC series are used as input ground motion and compared in term of response.

The study investigates how conservative or unconservative the fragility curves are when uncertainties in limit states are considered. Different parameters that influence fragility damping have a considerable effect in reducing displacements. Influence of other parameters like stiffness and acceleration threshold and uncertainties due to the structural model and input ground motion are also investigated.

OBJECTIVES
The objectives of this research are:
- Evaluate the probability of exceed a given performance limit threshold in the spectral space of acceleration and interstory-drift;
- Describe the limit threshold using random variables;
- Describe the multidimensional limit threshold using a generalized formula that includes both accelerations and displacement threshold;
- Develop a pre-processor in IDARC2D that allows multiple running and stores the data;
- Develop a post-processor in IDARC2D that allows the evaluation of fragility considering different option;
- Parametric analysis that shows the sensitivity of curves to different parameters;

METHODS & RESULTS

CONCLUSIONS
The development of fragility for different cases show how important is a correct evaluation of the limit threshold for example for comparison of different retrofit techniques. Besides if uncertainties of the limit state are not considered unconservative results can be developed. Parametric analysis has been performed to show the sensitivity of different parameters on fragility curves, calculated using the proposed technique.

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