SEISMIC FRAGILITY FOR RISK ASSESSMENT OF CONCRETE GRAVITY DAMS

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ABSTRACT

This paper presents a quantitative methodology including examples for developing seismic fragilities for concrete gravity dams using non-linear analyses with Latin Hypercube Simulation (LHS). Potential failure modes are defined, and seismic fragility curves are developed for the global failure of the dam as well as failure of the piers. Both the aleatory and epistemic uncertainties are considered, and most significant variables influencing the seismic fragility are identified and used in the analysis. Values of input variables influencing the seismic fragility are generated using LHS and randomly selected to develop seismic fragilities. Nonlinear seismic analyses are performed for thirty simulations at several ground motion levels. The ground motion variable includes 30 sets of acceleration time histories obtained from the actual earthquake recordings and matched to the target response spectrum. At each ground motion level, the probability of failure is determined based on the fraction of the simulation that resulted in dam failure. The results indicate that the seismic fragility is defined reasonably well with the lognormal distribution and provide the median seismic fragility including randomness and uncertainty variability for the base sliding and the pier failure.