

Seismic fragility estimation via dynamic analysis

In seismic risk analysis, fragility models that provide the conditional probability of structural failure given seismic intensity, can be integrated with site-specific seismic hazard to provide loss metrics. The state-of-the-art in performance-based earthquake engineering is to calibrate such structure-specific fragility models based on dynamic analysis of a numerical model of the structure that adequately represents nonlinear response to strong ground motion.

The purpose of this course is to acquaint the audience with consolidated strategies for fragility estimation using the results of dynamic analysis, such as incremental dynamic analysis, multiple-stripe analysis and cloud analysis. Topics that will be discussed during the course are procedures for seismic input selection appropriate for each analysis strategy, the selection and desired properties of conditioning seismic intensity measures, accounting for model uncertainty in the dynamic analysis, methodologies for fitting parametric probability models to the analysis results and inferential procedures for evaluating the standard error of risk estimates obtained. Towards the end of the course, interactive illustrative examples will be take place with direct involvement of the students, using simple inelastic structural models to develop fragility functions and estimate some metric of structural reliability.