

Modern risk assessment: Multiple probabilistic models and unified reliability analysis

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This presentation addresses a recent trend in the structural engineering community. Instead of relying solely on code compliance as basis for decisions, forecasted “performance” is now considered. This trend is motivated, in part, by observations in recent North-American earthquakes. Apparently, the design codes served the intended purpose of ensuring life safety, while damage, downtime, and other measures of performance were deemed unacceptable. Moreover, current design codes suffer from a more general shortcoming: lack of consideration of impacts that occur away from the actual building site, both environmental and economic. Prediction of infrastructure performance defines the scope of this presentation. The problem requires a rethinking of traditional engineering analysis, for two reasons. First, the models should be probabilistic and unbiased. In other words, uncertainties should be modelled and typical “simplifying conservative shortcuts” should be exposed and removed. The ideal model is one that simulates the reality when given realizations of the intervening aleatory and epistemic random variables. Second, the reliability analysis that computes the performance predictions must tackle multiple probabilistic models in one analysis. An intuitive example is consideration of regional infrastructure, with multiple models for hazards, building, bridges, and consequences. New software and a comprehensive example will be presented and discussed.