17th Symposium on Earthquake Engineering
November 14-17, 2022
IIT Roorkee, India
Paper No. 458

Importance of Epistemic Uncertainty on Seismic Analysis of RC Wall-frame Buildings

Nabajit Sarkar[1], Kaustubh Dasgupta[2]

[1]Department of Civil Engineering, Research Scholar, Indian Institute of Technology, Guwahati
[2]Department of Civil Engineering, Associate Professor, and Centre for Disaster Management and Research, Adjunct Faculty, Indian Institute of Technology, Guwahati

Abstract

During the seismic vulnerability assessment of structures, uncertainties can be considered from two sources, namely (a) aleatory characteristics and (b) epistemic characteristics. However, response variability is primarily attributed to the aleatory uncertainties, and the propagation of epistemic uncertainties through the analysis is generally not considered. In the present study, the influence of the epistemic uncertainties on the seismic response performance of a reinforced concrete wall-frame building is evaluated separately, and then compared with those obtained using aleatory uncertainties only. The variability in seismic demand is considered using a suite of ground motion records. A total of 11 ordinary strong motion records are selected using the magnitude-distance categorization, which ensures consideration of a wide range of earthquake scenarios. The uncertainty related to structural capacity is accounted for by considering 20 different structural models generated using Latin Hypercube sampling technique with different realizations of six input random variables. Considering the computational expense of incremental dynamic analysis, the variability in several response parameters is studied using single stripe nonlinear response analyses at a seismic intensity level indicating near collapse state of the selected wall-frame building. Consistent with earlier findings, it is noted that the impact of the epistemic uncertainties on seismic response variability is lesser as compared to those due to aleatory uncertainties. However, completely ignoring the contribution of epistemic uncertainties in response variability may not be prudent for a comprehensive seismic fragility estimate of wall-frame buildings. Thus, all sources of uncertainty need to be considered to ensure a reliable performance-based assessment of wall-frame buildings.

Keywords: Shear wall, Wall-frame building, Epistemic, Aleatory, Uncertainty, Seismic fragility, Incremental dynamic Analysis, OpenSees