



Influence of Epistemic Uncertainty on the Seismic Vulnerability of Indian Code-Compliant RC Frame Building

Kaushik Gondaliya¹, Vishisht Bhaiya¹, Sandip Vasanwala¹, Atul Desai¹, Jignesh Amin²

¹Department of Civil Engineering, Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India

²Department of Civil Engineering, Graduate School of Engineering and Technology- Gujarat Technological University, Chandkheda, Gujarat- 382424, India

Abstract

The study's primary goal is to examine the presence of epistemic uncertainty in the RC frame when subjected to lateral force. The seismic response of the RC frame and the impact of uncertainties, namely material ($\gamma_c, f_c, & f_y$) and geometrical (D_b & b_c) nonlinearity, on the structural elements are determined using nonlinear static analysis. A fragility curve for a 4-storey RC frame structure designed using the most recent IS 1893 for seismic zone-V was created using a simulation-based method. The traditional deterministic technique was also utilised to compare the effect of the structure's lateral response uncertainty. The classifications for the various damage levels, including slight, moderate, severe, and complete, were established. The random variables are the strength properties of the concrete (f_{ck}) and steel (f_y) materials, the depth of the beam (D_b), the width of the column (b_c), and the weight density of concrete (γ_c). The Monte Carlo technique is used to determine the structural randomness of the RC frames. The gathered data demonstrated a significant increase in the fragility uncertainty and structural responsiveness compared to the deterministic technique. A fundamental conclusion of this study is the critical relevance of tackling issues about the building's fragility and predicted damage state from a stochastic perspective.

Keywords: RC frame, Epistemic uncertainty, Seismic vulnerability, Pushover analysis