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GNU-Octave Tool for Probabilistic Seismic Hazard Assessment

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Abstract

Earthquake-resistant design of structures is aimed at withstanding a certain level of ground shaking with repairable damage and avoid structural collapse in more severe sharking. The design ground motion for a particular region is defined by estimated seismic hazard which may be presented in various formats. The uncertainties in seismic source characterization, lower and upper bound magnitudes, earthquake recurrence laws and ground motion prediction equations play an essential role in developing the seismic hazard curves. This study provides a simple and effective way for estimating seismic hazard curves using the GNU-Octave platform while accounting for all uncertainties. GNU-Octave is a free and open-source numerical computing platform. For the implementation, three regions from seismic zone IV (namely, Delhi, Patna and Darjeeling) and zone V (namely, Guwahati and Mandi) are selected as per the IS-1893. The earthquake catalogues are collected from various sources, mainly from the United States Geological Survey (USGS). Before using them to estimate the seismicity using the Gutenberg-Richter (G-R) recurrence relationship, these raw catalogue entries need to undergo some treatment (specifically, homogenization, declustering, and completeness check). Because of its simpler format and limited number of parameters, the ground motion prediction equation by Boore and Atkinson is utilised for ground motion intensity measure (IM). The seismicity of the Darjeeling region, which is categorised in zone IV of IS-1893, is found to be miscalculated based on the hazard curves for these locations, putting the structure in this region at greater risk.

Keywords: Seismic hazard, Structural design, GNU-Octave, Seismicity