8th International Conference on Seismology & Earthquake Engineering
11-13 Nov. 2019, Tehran, Iran

SYNTHETIC STOCHASTIC EARTHQUAKE SCENARIO PREDICTIVE MODEL, CASE STUDY: THE IRANIAN PLATEAU

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Keywords: Accelerogram, Aftershock; Earthquake scenario, Mainshock, Pulse-like signal

Mainshock events are followed by the cluster of aftershocks, each of these upcoming events may cause considerable level of damages to the buildings, infrastructures, life-lines, and etc. From the engineering perspective, it is highly important to evaluate the effects of aftershocks on building behaviors (2019). However, mostly, this natural phenomenon is neglected in the building and structural design codes (ASCE7-16 (2016), Eurocode8 (2004), since there is neither a sufficient number of appropriate natural aftershock accelerograms nor the model for generating the artificial aftershock accelerograms. In more general cases, it is even possible for a structure to experience more than one mainshock during its lifetime followed by the corresponding aftershocks. By reviewing the previous research works, it is observed that there are two separate sets of works, a first group attempts to simulate a set of random earthquake events or catalogs like the ones proposed by Zhuang and Ogata (2004), Randal et al. (2016), Ommi et al. (2016, 2017). On the other hands, there are several other works which only deal with the generation of stochastic accelerograms such as Boore (2003), Zentner and Poirion (2012), Rezaeian et al. (2008, 2010, 2012), and etc. From the engineering perspective, the important and dominant parameter on the damage evaluation of buildings, infrastructures, bridges, humans, etc. is the acceleration imposed on the earth surface by the earthquake. This fact implies the importance of forecasting the earthquake accelerograms not only for a single earthquake events, but also for the all probable mainshocks and aftershocks in the lifetime of any structure. In this research, it is aimed to propose a new model capable of simulating random mainshock-aftershock events scenario and also producing their corresponding accelerograms for the engineering purpose, i.e., seismic risk assessment of structures (Figure 1). In this regard, first, a catalog of earthquake events occurred in the Iranian plateau is gathered and processed. Next, the probabilistic-based relationships are developed to model the number of mainshocks and aftershocks, their occurrence time, and the corresponding magnitude. By using these models, the random event earthquake scenario (mainshocks-aftershocks). In the next step, the probability density functions of major seismological event properties such as focal depth, site-to-source distance, and the shear wave velocity of underlying soil layer are obtained for the Iranian plateau (Figure 2).

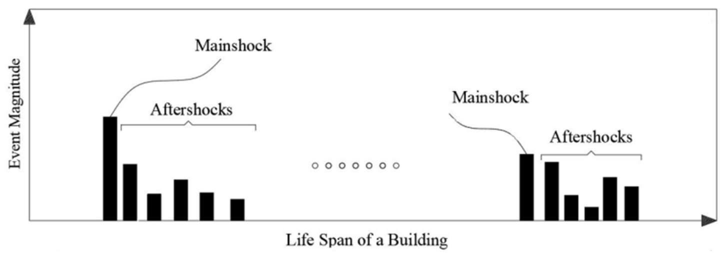

Figure 1. Schematic of earthquke scenarios during the lifetime of structures.

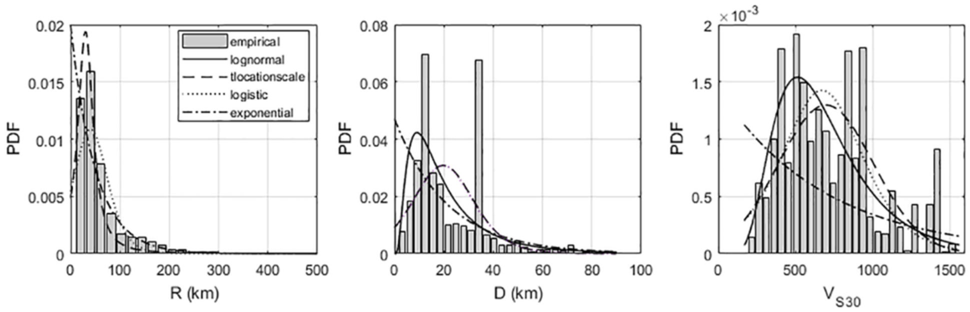

Figure 2. Schematic of earthquke scenarios during the lifetime of structures.

In the end, by adopting the existing predictive model of generating synthetic stochastic accelerograms for the Iranian plateau (Khansefid et al., 2019), for each produced seismological event in the previous step, the corresponding acceleration signals are simulated. Meanwhile, the proposed model has the capability of considering the near-field pulse-like effects in the generated signals. Generally speaking, this model offers a powerful tool to the scientist and engineers for simulation the long-term seismic scenarios including the corresponding accelerograms applicable for the long-term risk or life-cycle cost assessment.

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