FRAGILITY CURVES FOR A 5-STORY STEEL BRACED FRAME IN NEAR-FAULT AREA

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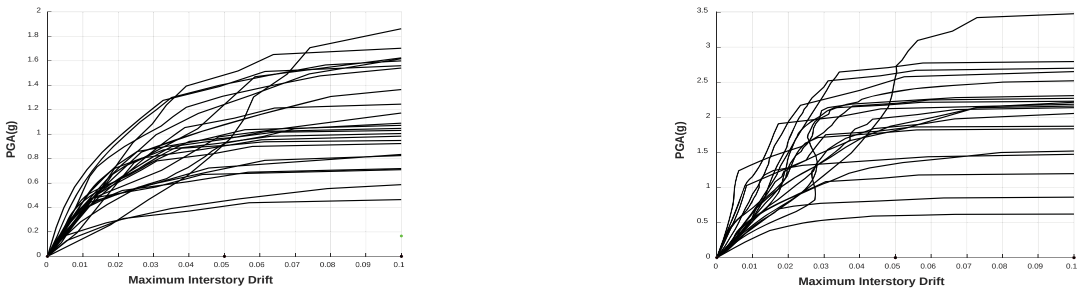
Keywords: Fragility, Near-fault, IDA, Braced-frame, Mid-rise building

Iran is one of the seismically active regions in the world with devastating earthquakes in its history that always caused a lot of casualties and financial losses. Building damage is one of the main issues in reducing seismic hazards especially in urban areas. Most of the big cities in Iran are located close to the active faults where the directivity pulse could produce, and largely affects the damage and its distribution. Therefore, the vulnerability of the buildings in close proximity to the active faults need to be carefully treated. In addition, fragility curves play an important role in estimation of buildings vulnerability. Building seismic fragility describes the likelihood of damage due to random ground motions. These curve represent relationship between damages happened to building with respect to strong ground motions measures such as intensity, peak ground acceleration (PGA), velocity (PGV) and etc. Therefore, accuracy in determining these curves has a direct relationship with the accuracy of estimating damages. One of the methods in developing of fragility curves is the use of empirical damage data, which are gathered during previously occurred earthquakes. However, the quantity and quality of collected field data usually includes limited building types. An alternative is to use analytical methods such as incremental dynamic analysis (IDA) to develop the fragility curves for different types of structures. Meanwhile, it is important to examine that these fragility curves are good enough to be used in near-fault area as well.

In this paper, the fragility curves for a mid-rise steel building is developed by using non-linear IDA method for near-fault and far-field areas. To this end, a 5-story steel concentrically braced-frame building was modeled and subjected to the two sets of ground motions including near-fault and far-field motions. The building model has three bay in both directions and a disciplined plan. Each set of motion contains 10 records adopted from FEMA P695. The model was subjected to the records, which were scaled to predetermined intensity values. Then, the building response in the form of inter-story drift ratio with respect to the PGA were calculated (IDA curve) as shown in Figure 1. Next, the fragility curves for different levels of damage including slight, moderate, severe and complete were developed for near-fault and far-field motions by using statistical analysis of derived IDA curves. The damage index for each damage level were adopted from those introduced by HAZUS (2003).



(a) (b)

Figure 1. The computed IDA curve for: a) near-fault motions, and b) far-field motions.

In Figure 2, the fragility curves for near-fault motions were compared with those derived for far-field motions. The results show an increase of 2% to 17% for building damage by the near-fault curves compared with the far-field curves in collapse level.

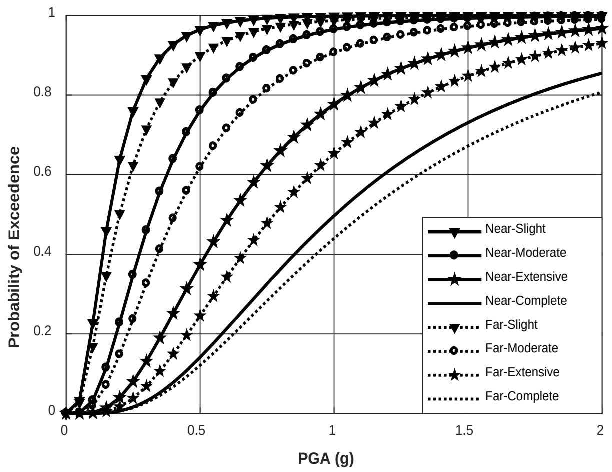


Figure 2. The comparison between developed IDA curves using near-fault and far-field motions in different damage levels.

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