HOW EFFICIENT THE GENERALIZED CONDITIONAL INTENSITY MEASURE IS?

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Record selection plays crucial role in the nonlinear analysis of structures. Several approaches have been emerged in this area of research in which the Generalized Conditional Intensity Measure (GCIM) is one of them (Bradley, 2010). This approach takes the (log-normal) distribution of different (scalar) Intensity Measure (IM) into consideration (Jayaram and Baker, 2008). Then the records which have the closest match with these IM distributions are selected. This approach is comprehensively assessed in this paper in order to examine its efficiency. A set of 267 pairs records are selected with the magnitude range greater than five and the distance less than 100 km (Baker and Cornell, 2006). Seventeen different IMs are taken into account and their (log-normal) cumulative distribution functions are calculated. The considered IMS are: Spectral acceleration at T= 0.1, 0.2, 0.3, 0.5, 1.0, 2.0, 5.0, 10.0, Peak Ground Acceleration (PGA), Peak Ground Velocity (PGV), Arias Intensity (IA), Cumulative Absolute Velocity (CAV), Displacement Spectrum Intensity (DSI), Acceleration Spectrum Intensity (ASI), Spectrum Intensity (SI) and Duration (Ds575, Ds595). Then, eight records are selected among the whole dataset in which their CDFs have the minimum deviations when compared with the CDFs based on the whole dataset. The Genetic Algorithm (GA) is employed in order to solve this optimization problem. The final selected records list is shown in Table 1.

The given structure in this paper is supposed to be the SPEAR building. The detail characteristics can be found in (Negro et al., 2004). The SPEAR building is a 3-storeyed 3D reinforced concrete structure for which a pseudo-dynamic experiment was performed at full scale at the ELSA Laboratory, within the European research project SPEAR ("Seismic performance assessment and rehabilitation of existing buildings") (Negro et al., 2004). The structure has T_1=0.85 sec. A more detailed explanation of the model and comparison of experimental and numerical results can be found in (Fajfar, et al., 2006). The response of the given structure was calculated by means of the incremental dynamic analysis as seen in Figure 1. The summarized IDA curves in Figure 1 are corresponding to the whole data and the selected eight records. As seen in Figure 1, although the selected records have fully compatible CDFs with the CDF based on the whole records bin, however, the structural response is meaningfully different. This difference is more significant in the 16th and 84th fractiles which means that the GCIM approach is inefficient in order to be used for estimating the structural response deviations. It is worth mentioning that the median response is accurately estimated by using the GCIM approach in the low IM range. However, in the high IM range, corresponding to the high levels of structural nonlinearity, the median response has also biased.

Table 1. The selected records list based on the GCIM approach

PEER ID	Earthquake Name	YEAR	Station Name	Magnitude	ClstD (km)
352	Coalinga-01	1983	Parkfield - Gold Hill 3W	6.36	41.10
888	Landers	1992	San Bernardino -E & Hospitality	7.28	79.76
777	Loma Prieta	1989	Hollister City Hall	6.93	27.60
460	Morgan Hill	1984	Gilroy Array #7	6.19	12.07
980	Northridge-01	1994	Huntington Beach - Lake St	6.69	77.45
988	Northridge-01	1994	LA - Century City CC North	6.69	23.41
1003	Northridge-01	1994	LA - Saturn St	6.69	27.01
31	Parkfield	1966	Cholame - Shandon Array #8	6.19	12.90

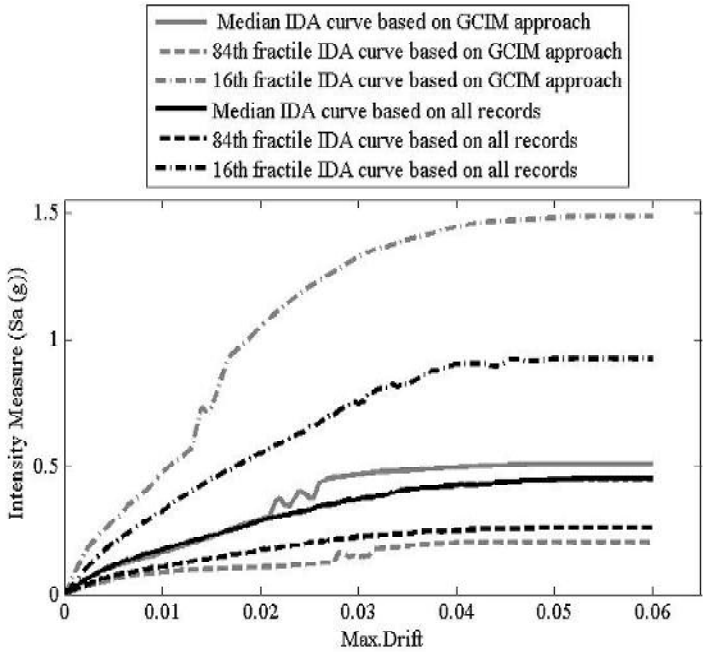

Figure 1. The comparison between IDA curves obtained based on the selected records and the whole records.

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