

Procedures for determination of precedence list of ground motion records for progressive incremental dynamic analysis

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Abstract

Incremental dynamic analysis (IDA) (Vamvatsikos and Cornell, 2002) is widely used for performance assessment of structures under seismic loading, but it does not address how many ground motion records are required for sufficiently accurate prediction of seismic response of a structure. This issue was solved by introducing progressive incremental dynamic analysis (PIDA) (Azarbakht and Dolšek, 2011) which involves precedence list of ground motion records. In PIDA, the IDA curves are computed progressively, starting from the first ground motion record in the precedence list. After an acceptable tolerance has been achieved, the analysis is terminated. Computational efficiency of progressive IDA depends on the procedure used to define the precedence list of ground motion records.

In the study precedence lists of ground motion records were defined based on different procedures. Firstly the precedence list was determined by matching the median acceleration spectrum of selected records with a target acceleration spectrum. In addition to this common approach, precedence lists of ground motion records were determined by utilizing the IDA analysis performed for the SDOF model or web-based approximate IDA (Peruš et al, 2011). The efficiency of precedence lists of ground motion records to predict seismic response by the smallest number of records is demonstrated by means of seismic performance assessment of reinforced concrete frames.

It was found that sufficiently accurate seismic response of buildings can be predicted with less than 10 records out of 40 if progressive IDA involves precedence list of records which is determined based on the seismic response of an equivalent SDOF model. Precedence list of records, which utilize acceleration spectra, is less efficient.

References

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