RAPID ESTIMATION OF FRAGILITY CURVESUSING ENDURANCE TIME METHOD

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ABSTRACT

Randomness of earthquakes' inherent causes scattering of structural responses. The most complex analytical methods such as risk, hazard and performance based design try to estimate seismic responses properly. Most of the time, damage probability of structures are studied using fragility curves. Multi-strip analysis (MSA) and incremental dynamic analysis (IDA) are the most dynamic analysis methods which evaluate seismic responses in different intensity measures (IMs). Numerous nonlinear dynamic analyses needed in mentioned methods to evaluate response distributions lead to complexity and time consuming process of them. Endurance time analysis (ETA) evaluates structural responses in different IMs by using artificial intensifying acceleration functions with least dynamic analysis. In this paper a new approach has been suggested to obtain fragility curves rapidly using ETA. Hence, the capability of ETA is evaluated to determine fragility carves by making use of equivalent SDOF instead of MDOF system. Results show that ETA method applied to an equivalent SDOF system predicts MSA fragility curves obtained by analysing a MDOF system with appropriate accuracy, by applying an uncertainty factor of 0.6 to lognormal standard deviation of ETA method.This approach reduces hugecomputational efforts and consumed timewhich are spent on the otherproccesswith a neglecting tolerance.

INTRODUCTION

To study precisely on responses of buildings subjected to earthquake, some complex seismic analysis have been developed that each one gives some results with different difficulties.

Hazard analysis, seismic risk assessment and performance based design are some of advance approaches inthe seismologic science.They study probability of exceedance in responses from limit state. The probability of exceedanceis illustrated by cumulative distribution functions called fragility curves.

Fragility functions use structural response distributions obtained from nonlinear dynamic analysis. There are many analysis methods which evaluate response distributions of structures. Multi-strip analysis (MSA) is the most well-known procedure which has been proposedrecently.MSA consist of a set of nonlinear time history analysis in which various ground motions (GMs) are scaled to desire intensity measure (IM) and repeated by increasing IMs' level (Jalayer(2003)). Therefore, distribution of engineering demand parameters (EDPs) could be evaluated in each IMs' level. The number of selected GMs is an important parameter in MSA. To achieve an accurate response distribution, various GMs should be