Comparative Study of the Statistical Methods of Fragility Curve Generation

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Abstract

Fragility function is defined as the graphical representation using the curves to express the occurrence of undesirable event as a function of some measure. Fragility Curves has been developed based on results of incremental dynamic analysis. The common form of seismic fragility function is Log-normal Cumulative Distribution function (CDF). The main objective of the study is to develop the best method to find the value of mean and the standard deviation which gives a minimum deviation to that of real Cumulative Probability Density (CPD). For this we have taken data from [1] VULNERABILITY ASSESSMENT OF MRT 205:1994 BUILDING and formulated a program of "Minimum Difference Method" using python. This study shows the reliability of "Minimum Difference Method" in comparisons to the others existing methods.

Keywords: Building, seismic time history, In-fill, FEM modelling, SeismoStruct®, Seismic performance, Fragility, Log-normal Distribution.

1 Introduction

Fragile means "easily broken" and Fragility means the "tendency of getting broken". Fragility Curve has become one of the terms and tools to determine the reliability of a building when subjected to an earthquake. Fragility curves have been developed based on the results of incremental dynamic analysis considering seven damage states slight, light, moderate, extensive, partial collapse and collapse as proposed by T. Rossetto [2] based on inter-storey drift ratio.

Kennedy et al. (1980) [3] defined a fragility function as a probabilistic relationship between frequency of failure of a component of a nuclear power plant and peak ground acceleration in an earthquake. More broadly, fragility function can be defined as a graphical representation using the curves, which express the probability of occurring the undesirable events as a function of some measure of environmental excitation (typically a measure of force, deformation, or acceleration in an earthquake, hurricane, or other extreme loading condition).

The concept of Incremental Dynamic Analysis has recently gained popularity and it is used as a method to estimate the global capacity of structural systems [4]. The method constitutes subjecting a structural model to one or more ground-motion records, each scaled to multiple levels of intensity. The results of these outputs are used and analyzed for the formulation of the Fragility Curves. The most common form of a seismic fragility function is the lognormal cumulative distribution function (CDF).

Objectives

The objective of this paper is to "Compare the Fragility Curves developed using different methods". The methods are;

- As proposed on the TECHNICAL NOTE: Efficient analytical fragility function fitting using dynamic structural analysis by Jack W. Baker.

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