

REDUCING EPISTEMIC UNCERTAINTY OF PROBABILISTIC SEISMIC HAZARD ANALYSIS USING MONTE CARLO SIMULATION

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ABSTRACT

One of the significant concerns of conventional method of Probabilistic Seismic Hazard Analysis (PSHA) is management and treatment of uncertainties. These uncertainties originate from unavoidable reliance of PSHA on subjective decisions and using simplified assumptions and models in calculation. Monte Carlo simulation is actually a second approach for calculation of PSAH and provides a way for reducing such epistemic uncertainties. Monte Carlo simulation is a computational algorithm that relies on repeated random sampling for their results. This algorithm calculates seismic hazard by simulating of future pattern of ground shaking at the site. This method requires only information about past seismicity as minimum input data to generate a synthetic catalog. This simple method is a potent approach to bypass the need for identifying and quantification of parameters and models and as a result, decrease epistemic uncertainty of analysis. In this paper, a comprehensive comparison is made between the results of conventional PSHA and Monte Carlo simulation approach in order to reveal the influence of epistemic uncertainty on conventional PSHA and the power of Monte Carlo approach in controlling these uncertainties. To this end, a number of analyses have been carried out for a site in Tabriz city, Iran. It is turned out that Monte Carlo simulation introduces a way to reduce such kind of uncertainty.

1. INTRODUCTION

Evaluation of seismic hazard at an area is one of the most momentous subjects of earthquake engineering. The aim of seismic hazard analysis is determining probability of occurrence of specific level of ground shaking within a given future time interval. One of the substantial concerns of such calculation is manipulating of uncertainty induced by lack of precise information about source geometry and location, recurrence of seismic events at the source and influence of site effects. The proper way of dealing with and modeling of these uncertainties in analysis is a significant issue in seismic hazard; because, the results of seismic hazard can be influenced heavily by these uncertainties.

The first formulation for handling these uncertainties was proposed by Cornell (1968) and later enhanced by Mc-Guier (1976) in the general framework of PSHA. This method is now widely used and often seen as a general tool for seismic hazard analysis. This method is formed on the basis of total