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A Seismic Model for Active Faults of Central Alborz Zone and Comparison of Response Spectra with BHRC Code 2800

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Abstract

High seismic potential of central Alborz zone requires a thorough study of the seismicity of this area. In this research, the Haskell fault model was brought into consideration along with the numerical solution of three-dimensional wave equation to develop displacement, velocity and acceleration time-histories of active strike-slip faults in central Alborz region. Then, the recorded events were used to calibrate the model parameters, such as the seismic moment rate and fault rupture velocity required for development of artificial synthetic earthquakes. Results showed relatively good consistency between the predictions made by the model and those instrumentally recorded. Eventually, the developed model was employed to compare the response spectra found artificially with those suggested by standard Code 2800 of BHRC.
Keywords: Haskell fault model, Synthetic earthquake, seismicity, Response spectra.

1. INTRODUCTION

The earthquake, has been given special consideration in the recent decades, as one of the most adverse natural phenomena in the human life. Its destructive nature and its damage to human life, buildings and facilities has attracted a number of scientists among the world to understand the mechanism of the earthquake and to find a way to quantify the upcoming events which is of particular importance in analysis and design of structures. Several codes and guidelines have been developed to provide design criteria to withstand the catastrophic effects of an earthquake (Naeim, 2001; Clough and Penzien, 2003; ASCE7, 2005; El Nashai and Di Sarno, 2008) [1-4].

As a seismic geotechnical standpoint, although the a complete description and anticipation of an event is impossible, due to several uncertainties associated with an earthquake, attempts have been made to develop a theoretical method to better understand seismic events (Haskell, 1964 and 1969; Brune, 1970; Trifunac and Lee, 1990; Kato, *et al.*, 1999; Aki and Richards, 2002) [5-10]. As a structural engineering standpoint on the other hand, it is required to find the structural response to a seismic event and hence, it is important to develop an appropriate record of the maximum credible earthquake or its response spectrum. Development of synthetic earthquake records may be of particular interest as it provides a basis for such records or such response spectra. The wave propagation theory due to a disturbance in an elastic medium has drawn special attention in development of synthetic earthquake ground motion time histories (Haskell, 1969; Brune, 1970; Rizzo *et al.*, 1975 as classical attempts) [6,7,11].

In this paper, the Haskell fault model has been employed to find a fault rupture model and its associated parameters in a 2D analysis for Guilan Province. This model is implemented in the numerical solution of 2D wave equation and model parameters are calibrated with real earthquake records. The calibrated model is then employed to compare the synthetic earthquake record thus obtained, with the design response spectrum provided by the BHRC code 2800 [12].