Simulation of earthquake records using combination of wavelet analysis and non-stationary Kanai-Tajimi model

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Abstract. This paper is aimed at combining wavelet multiresolution analysis and nonstationary Kanai-Tajimi model for the simulation of earthquake accelerograms. The proposed approach decomposes earthquake accelerograms using wavelet multiresolution analysis for the simulation of earthquake accelerograms. This study is on the basis of some Iranian earthquake records, namely Naghan 1977, Tabas 1978, Manjil 1990 and Bam 2003. The obtained results indicate that the simulated records preserve the significant properties of the actual accelerograms. In order to investigate the efficiency of the model, the spectral response curves obtained from the simulated accelerograms have been compared with those from the actual records. The results revealed that there is a good agreement between the response spectra of simulated and actual records.

Keywords: earthquake ground motion; simulation; non-stationary model; wavelet analysis; Kanai-Tajimi model.

1. Introduction

Seismic design of structures requires a dynamic analysis procedure either response spectrum or time- history. The major drawback of response spectrum analysis lies in its inability to obtain time information of the structural responses. Such information is sometimes necessary in achieving a satisfactory design.

In many cases, structures' house equipment is sensitive to floor vibrations during an earthquake. It is sometimes necessary to develop the floor response. In addition, in designing critical or major structures such as power plants, dams, and high-rise buildings, the final design is usually based on the complete time-history analysis. To provide input excitations for structural models in sites with no strong ground motion data, it is necessary to generate artificial accelerograms.

The modeling and simulation of earthquake ground motion signals are important in structural earthquake engineering and may significantly facilitate the study of structural behavior under seismic excitation. The main difficulty in modeling such signals stems from their strongly non-stationary nature.

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