New method for generation of artificial ground motion by a nonstationary Kanai-Tajimi model and wavelet transform

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Abstract. Considering the vast usage of time-history dynamic analyses to calculate structural responses and lack of sufficient and suitable earthquake records, generation of artificial accelerograms is very necessary. The main target of this paper is to present a novel method based on nonstationary Kanai-Tajimi model and wavelet transform to generate more artificial earthquake records, which are compatible with target spectrum. In this regard, the generalized nonstationary Kanai-Tajimi model to include the nonstationary evaluation of amplitude and dominant frequency of ground motion and properties of wavelet transform is used to generate ground acceleration time history. Application of the method for El Centro 1940 earthquake and two Iranian earthquakes (Tabas 1978 and Manjil 1990) is presented. It is shown that the model and identification algorithms are able to accurately capture the nonstationary features of these earthquake accelerograms. The statistical characteristics of the spectral response of the generated accelerograms are compared with those for the actual records to demonstrate the effectiveness of the method. Also, for comparison of the presented method with other methods, the response spectra of the synthetic accelerograms compared with the models of Fan and Ahmadi (1990) and Rofooei *et al.* (2001) and it is shown that the response spectra of the synthetic accelerograms with the method of this paper are close to those of actual earthquakes.

Keywords: artificial accelerogram; wavelet transform; target spectrum; nonstationary model; Kanai-Tajimi model.

1. Introduction

Dynamic response analysis of structures to earthquake ground motion is one of the basic requirements for their seismic design. While response spectra method is the currently favored approach, there are situations for which a time history analysis is necessary. Typical examples are qualification of sensitive equipment, evaluation of floor response, and response analysis of nonlinear structures and structural components. The number of recorded accelerograms, however, is too limited to allow the selection of a standard typical record for a given site. Furthermore, under

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