Effect of Accelerogram Trajectory of Bi-directional Spectrum-Compatible Waves on Nonlinear Seismic Response of Structural Model

Kazuma Inoue,

National Institute of Technology, Gunma College, Gunma, Japan

Kazuaki Watanabe

Taisei Corporation, Tokyo, Japan

Akira Igarashi

Disaster Prevention Research Institute,kyoto University, Kyoto, Japan

Contact: inoue@cvl.gunma-ct.ac.jp

Abstract

The difference of orbit characteristics of bi-directional input waves affecting the elast-plastic response of structural model is investigated.The proposed method extends conventional 1D spectrum-compatible method to 2D, and shows how to match the random trajectory time histories, which is orthogonal in the horizontal plane, with the target bi-axial response spectrum. By extenting the energy spectrum which represents the energy of input seismic motion, the concept of bi-axial energy spectrum is proposed. Using this spectrum, differences in input seismic energy is shown when accelerogram trajectories of the waves vary. In addition, incremental dynamic analysis was carried out for elasto-plastic structural model, subjected to bi-axial response spectrum-compatible waves with different accelerogram trajectories. As a result, there is tendency for using circular trajectory as bi-directional input to show conservative results.

Keywords: bi-directional input; bi-directional response; Accelerogram Trajectory; Hilbert Transform; Bi-axial Response Spectrum; Incremental dynamic analysis

1 Introduction

The development of computational processing performance of computers contributes to improvement of analytical techniques for various phenomena. In the field of earthquake and structural dynamics engineering, it is becoming possible to perform seismic performance assessment of structures by large scale 3D seismic response analysis subjected to horizontal bi-directional input.

In the past research, several methods of generating bi-directional ground motion matched to response spectrum has been proposed. A method of using a combination of standard seismic design wave adapted to the design response spectrum and a complementary orthogonal component wave computed by its Hilbert transformation of the

https://doi.org/10.2749/nantes.2018.s23-91
Distributed by structurae