Generation of RotD100 spectrum-compatible bi-directional ground motions with specific orientation angle

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Abstract
With the increase of structural nonlinear time history analysis under bi-directional ground motions, the demand for the employment of RotD100 response spectrum-compatible bi-directional ground motions has also increased. However, only spectrum-compatible bi-directional ground motions cannot guarantee a correct evaluation of the structural seismic response, but the appropriate seismic inputs. The orientation angle (OA) of bi-directional ground motions is a new concept and affects the nonlinear response of structures. And it will be preferable in the seismic design that if the concerned feature of bi-directional ground motions can be specified in a controllable manner. Therefore, in this paper, a new algorithm is proposed for the generation of RotD100 response spectrum-compatible bi-directional ground motions with a specific OA at each natural periods. This algorithm is based on the complex-discrete Fourier-transform (CDFT), which takes the advantage of controlling the azimuth angle (AA) of ellipse at each natural periods in the frequency domain. The proposed algorithm is validated using a target RotD100 response spectrum and a pair of bi-directional ground motions. It is shown that the performance of the proposed algorithm is satisfactory and its application is straightforward in the relative fields of earthquake engineering.

Keywords: spectral matching; orientation angle; bi-directional ground motions; complex discrete Fourier transform

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