Full-Waveform Ground-Motion Simulation and Its Application to Seismic Hazard Analysis

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Nowadays full-waveform ground-motion simulations from physical aspects are necessary for earthquake-induced ground-motion prediction and seismic hazard assessment. Damages to engineering structures by an earthquake depend on the entire time history of the ground motion, which is affected by a number of factors including source-rupture process, subsurface velocity structure, topographic relief, and local site condition. Among these four factors, the source process may be most important because it leads to directivity effect, a major factor in determining the spatial pattern of the ground motion. Furthermore, effective modeling of the effects of structural heterogeneity, surface topography, and site amplification is necessary in order to achieve more realistic synthetic seismograms. In this study, we present a physics-based full-waveform ground-motion simulation scheme and its application to seismic hazard analysis. We carried out simulations to capture overall ground-motion characteristics at important sites with accounting for effects of (1) multiple source-rupture scenarios, (2) seismic wave propagation, (3) surface topography and (4) site amplification in modeling realistic synthetics. This ground-motion simulation scheme has been compared with probabilistic seismic hazard analysis (PSHA) results for the Science Park in southern Taiwan. Thus, the full-waveform ground-motion simulation technique has the potential to provide additional constrains for seismic hazard assessment and mitigation.

Keywords: ground motion simulation, seismic hazard analysis, PSHA

