

Broadband Strong Motion Simulation for Hypothetical Earthquakes under Tokyo Metropolitan Area using the Stochastic Source Method

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We have improved the stochastic Green's function method (Kamae et.al, 1998) to simulate broadband strong motions considering layered half-spaces, and applied it to simulate broadband strong motions for hypothetical earthquakes under the Tokyo Metropolitan Area. In the method, we, first, generate strong motions from small earthquakes using the moment-rate functions based on stochastic source model (Boore, 1983) and the theoretical Green's function of layered half-space (Hisada, 1994, 1995). As for the phase spectra of the moment-rate function, we use random values at higher frequencies, and zeros at lower frequencies. We use the values of zero to not only simulate the coherent strong motions (i.e. the directivity pulse, the fling step) at lower frequencies, but also reproduce the seismic moment at the zero frequency. As for the radiation pattern, we use the theoretical pattern at lower frequencies and the homogeneous pattern with constant values (0.52 for the P wave and 0.63 for the S wave; Boore and Boatwrite, 1984) at higher frequencies. We, finally, generate the strong motion from a large earthquake using the same technique as the stochastic Green's function method, which follows the scaling law of the source spectra between the small and large earthquakes. This method can simulate broadband strong motions more accurately than the stochastic Green's function method, not only in near source region (including the effects of the near-field terms of Green's functions), but also at far field (including the effects of the surface waves, the Moho reflection waves, et al.). We tested the method to observed records for the Landers and Northridge earthquakes, and obtained excellent agreements at broad frequencies. Then, we applied it to strong motions for hypothetical earthquakes under the Tokyo Metropolitan Area, and found that they do not generate the directivity pulses clearly, as compared with the 1994 Northridge earthquake, which is a similar blind thrust fault; this is because the former has low dip angle (around 23 degree) whereas the latter has high angle (about 40 degree).