Koki Makita, Kyoichiro Kondo and Izuru Takewaki, 2018, Critical ground motion for resilient building design considering uncertainty of fault rupture slip, *Frontiers of the Built Environment,* 07 November 2018, doi.org/10.3389/fbuil.2018.00064

Abstract The process of theoretical ground motion generation consists of (i) the fault rupture process, (ii) the wave propagation from the fault to the earthquake bedrock, (iii) the site amplification. The uncertainty in the site amplification was taken into account in the previous research (Makita et al., 2018). On the other hand, the uncertainty in the fault rupture slip (slip distribution and rupture front) is dealt with in the present paper. The wave propagation from the fault to the earthquake bedrock is expressed here by the stochastic Green's function method in which the Fourier amplitude of the ground motion at the earthquake bedrock from a fault element is represented by the Boore's model and the phase angle is modeled by the phase difference method. The validity of the proposed method is investigated through the comparison with the existing simulation result by other methods. By using the proposed method for ground motion generation and for optimization under uncertainty in the fault rupture slip, a methodology is presented for deriving the critical ground motion imposing the maximum response of an elastic SDOF model at the earthquake bedrock or at the free ground surface. It is shown that the critical response exhibits the SDOF response several times larger than that due to the average fault rupture slip model. Furthermore, the robustness evaluation with respect to the uncertain fault rupture slip and the uncertain fault rupture front is presented for resilient building design. Since the critical ground motion produces the most detrimental building response among possible scenarios, the proposed method can be a reliable tool for resilient building design.

Keywords critical ground motion, worst input, stochastic Green's function method, fault rupture, wave propagation, phase difference, site amplification, resilience.