Stochastic liquefaction hazard assessment for urban regions based on soil dynamics

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Abstract

Conventional assessment methods, e.g., using Factor of safety against Liquefaction (FL), only provide deterministic assessments and tend to overestimate hazards. In the past years, we have developed a liquefaction assessment framework based on soil dynamics analysis and high-performance-computing (HPC), capable of effective and efficient assessment for urban regions with tens of thousands of sites [1].

How to take into account uncertainties in a dynamic process is of great importance for dealing with practical engineering problems. Investigation based on the probability density evolution is one choice [2], Monte Carlo simulations is another [3], see Fig. 1. Considering that we have a HPC-based assessment framework, we adopted the latter. It allows us to investigate the influence from individual factors.

In this study, we apply Monte Carlo simulations to assess liquefaction hazard in an urban region of more than 10,000 sites. To take into account of uncertainties in soil properties, each site will be assessed by 100 statistical models rather than one deterministic model.

Keywords: **Liquefaction hazard assessment, Soil dynamics, Uncertainties, Statistic models, High performance computing**

References

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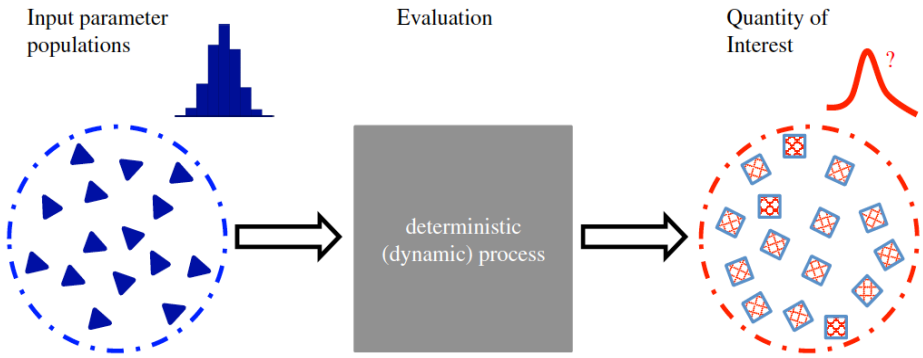

Fig.1 Stochastic liquefaction hazard assessment based on Monte Carlo simulations [3]: The occurrence of liquefaction is deterministic, assuming a full knowledge of soils and input ground motion, both of possess uncertainties which in reality. As a simplification, we only investigate the influence of uncertainties in soil properties regions for several determined input ground motions.