

【Grant-in-Aid for Scientific Research(S)】
Science and Engineering (Engineering)



Title of Project : Assessment of Earthquake Disasters Based on Multiple-Earthquake Scenarios for Next Generation Urban Area Model

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Research Area : Engineering, Civil Engineering, Structure/Earthquake Engineering

Keyword : Earthquake disaster mitigation, Earthquake disaster assessment

【Purpose and Background of the Research】

Integrated Earthquake Simulation (IES), which is aimed at simulating all phases of an earthquake disaster by applying large scale numerical computation, is being developed. Simulation considering multi-earthquake-scenarios is about to be realized. As shown in Fig. 1, the primary objective of this research is 1) to develop an automated model construction method for an urban area, and 2) to develop a processing method for huge amount of simulated results. The automated model construction method is based on a newly established theory. Developing the processing method is essential in order not to *finish* this research just only for the execution of large scale simulation.

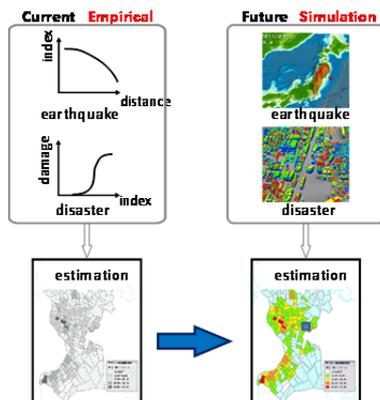


Fig. 1: Development of simulation-based earthquake disaster assessment.

【Research Methods】

The research consists of four phases. The first and second phases are aimed at developing the automated modeling method and constructing a next generation urban area model. The third and fourth phases seek to develop the processing method of data generated for multi-earthquake-scenario simulations and to analyze the numerical results (which would be of extremely large amount) of the multi-earthquake-scenario simulations. In the first and second stages, respectively, a code based on the meta-modeling theory is studied and the code is refined by examining the quality of the constructed model, respectively. In the third phase, various processing methods for Big Data are used to develop the processing method. The fourth phase studies Tokyo, Sendai and Kobe Cities as a specific example of the multi-earthquake scenario simulations.

【Expected Research Achievements and Scientific Significance】

The meta-modeling theory, which is essence in constructing a next generation urban area model, is unique in the sense that it guarantees the quality of the automatically constructed analysis models; see Fig. 3. Among various modeling methods of a multi-scale type, the meta-modeling is novel since it is applied to numerous buildings and structures. The meta-modeling theory is used to develop a fast solver and smart visualization. Earthquake disaster assessment that utilizes the multi-earthquake-scenario simulations inherently possess range in the assessment, which corresponds to the uncertainty of scientific prediction. Rational range of the disaster assessment is important, as it is never realized without using the multi-earthquake-scenario simulations. The processing method is developed for this objective is unique, as it is beyond the standard statistical analysis; see Fig. 3.

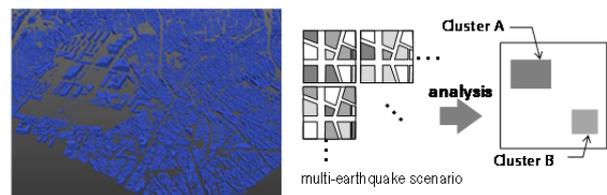


Fig. 2: Next-generation Urban area model constructed by meta-modeling theory.

Fig. 3: Processing of results of multi-earthquake scenario simulations.

【Publications Relevant to the Project】

- M. Hori, Introduction to computational earthquake engineering, 2nd edition, Imperial College Press, 2011.

【Term of Project】 FY2013-2017

【Budget Allocation】 85,100 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.eri.u-tokyo.ac.jp/LsETD/>