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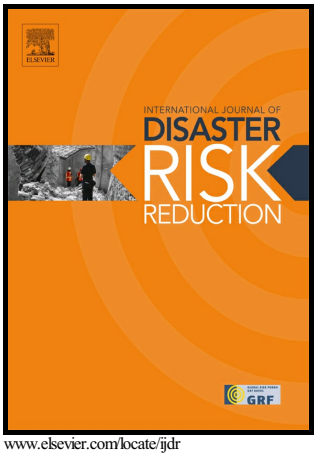

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Prototype of Seismic Loss Assessment Tool using Integrate Earthquake Simulation

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Abstract
This study develops a seismic loss assessment (SLA) tool incorporated with the Integrated Earthquake Simulation (IES) program for urban risk evaluation due to a scenario earthquake. This proposed SLA-IES tool uses a cost-effectiveness performance of physics-based models in IES, such as site amplification analysis and nonlinear structural response analysis, with soil boring and GIS data. In this study, Sendai City was selected as a case study for a prototype of the SLA-IES tool. For pre-processing, the tool was used to couple available raw data, such as building shape, building attribute, and soil boring data, and then generate input data for IES. For post-processing, this tool was used to translate output data from IES in order to obtain inter-story drift of each floor of each building. From inter-story drift, the SLA-IES tool evaluates damage state of a building, such as level I (none), level II (slight), level III (moderate), level IV (extensive), and level V (complete), for a scenario earthquake. Then, direct economic loss, such as repair cost, was estimated based on damage state and construction cost. The results of the SLA-IES tool were stored as a database of all individual buildings including damage level, repair cost, structural type (wooden, steel, reinforced concrete, and steel frame and reinforced concrete structures), and building occupancy (private, ordinary, office, and landmark buildings).

Keywords: seismic loss, IES, building damage, repair cost, Sendai, wooden building

1. Introduction
1.1 Background and previous studies
Disaster mitigation measures are important for sustainable safety of people in a growing city with rapid increase of buildings. Based on past experience in the 2011 Great East Japan earthquake, many buildings in Tohoku region were seriously damaged by severe ground shaking. In order to reduce economic loss against future expected large earthquakes, damage prediction plays a key role for constructing disaster mitigation measure and raising awareness of people. For reliable damage prediction in urban areas, computer technology has been applied to simulate earthquake scenarios with high performance computing (HPC) for large-scale problems which is called Integrated Earthquake Simulation (IES) [Ichimura and Hori, 2004; Ichimura et al., 2005; Hori et al., 2006; Hori and Ichimura, 2008; Hori, 2011; Fujita et al., 2014]. Integrated Earthquake Simulation (IES) is a scenario simulation tool from fault rupture to structural response for predicting and illustrating structural damage of all buildings in an urban area simultaneously in selected earthquake scenarios. From Geographic Information System (GIS) data, hundred thousands of buildings in this urban area are