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Comprehensive assessment for seismic risk in industry

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A research project to develop simultaneous risk assessment simulation tool based on the disaster researches of the 2011 Tohoku-Oki Earthquake was initiated to formulate measures for huge seismic risks. Another aim of this project is to control low probability - high consequence disaster causing huge social and economic damages. The proposed new risk assessment simulation tool includes diverse effects of primary disaster of earthquake or tsunami and secondary damages of industrial plants and atomic power plants or supply chains of various products including function of production and transportation. In this study, we focus on the industrial damage in Japan including secondary damage to the supply chains which might be caused by anticipated huge earthquakes such as the Tokai, Tonankai and Nankai Earthquakes.

The boundary and procedures of a comprehensive risk assessment was set as below.

- Considering building and factory damages in each company as seismic direct damage
- The direct damage to production loss in each industry in the considered region
- Production loss ratio represents reduction ratio of industrial production index
- The effect of secondary damage in each industry in each region is simulated by using a computable general equilibrium (CGE) model

Based on these procedures, we are now carrying out our research according to the steps below.

- Preparing the fragility curve of each industry
- Mapping the plants of each industry
- Recreating the damages using CGE model, by regions and industries, on information obtained from the experiences of the Tohoku Earthquake

The industry-specific fragility curve was created based on the damage studies (Naraoka et.al. 2012) and questionnaire for the past earthquakes. Reduction of industrial production index was resulted from many causes such as reduction of production, disruption of transportation, power failure, lack of water supply and shortage of employee. At the early stage of this study, we only consider reduction ratio in each industry, which is accumulated from regional statistics, such as a regional industrial statistics, a census of commerce of Japan and so on. Disruption of transportation, power failure, lack of water supply and shortage of employee will be taken into account in our future study.

Keywords: gigantic earthquake, industrial damage, risk assessment, fragility curve, supply chain, the 2011 Tohoku-oki earthquake