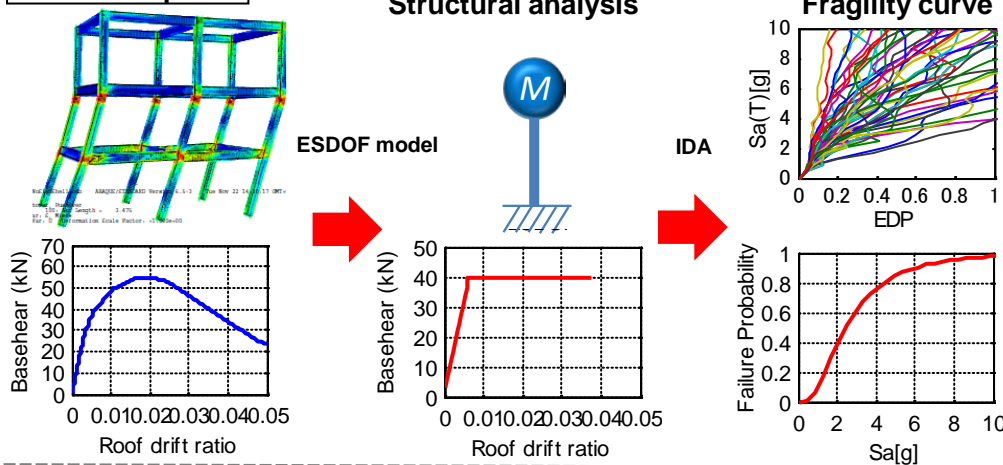# Post-Earthquake Decision-Making Based on Structural Health Monitoring and Aftershock Risk Analysis
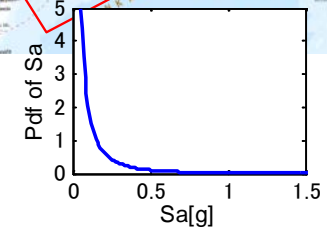
Background: After a huge earthquake, buildings subjected to strong ground shaking may suffer damage that possibly classifies them to be unsafe for occupancy. Knowing the aftershock risk can support post-earthquake decision-making on the re-occupancy of earthquake-affected buildings. This research presents an framework for identifying damage states and computing an index for aftershock risk.

Methodology: The aftershock risk of buildings with defined damage levels is evaluated stochastically based on fragility curve using incremental dynamic analysis and aftershock hazard analysis. After the mainshock, the damage level of the building is estimated from structural health monitoring. The combination of the pre-computed aftershock risk and post-event damage estimates yields the re-occupancy index for the damaged buildings. As an example study, this method is applied to the low rise steel frame building located in Osaka against the assumed Nankai megathrust earthquake.
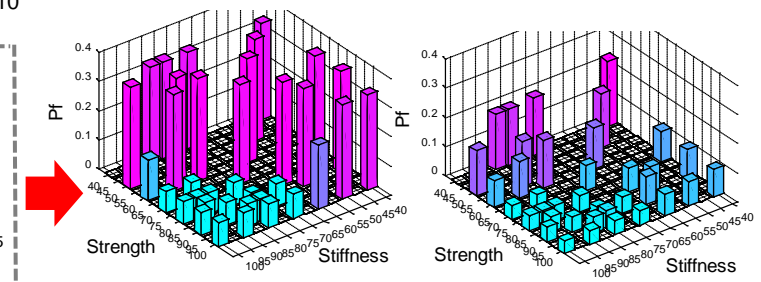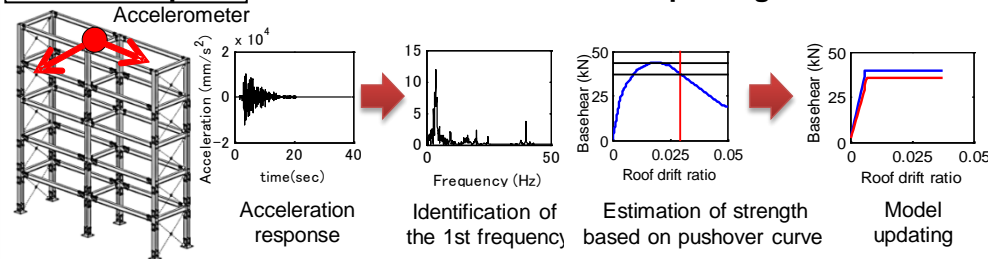
Pre-earthquake

Structural analysis

Fragility curve

ESDOF model

IDA

The estimation of failure probability

Aftershock hazard

Post-earthquake

SHM-based model updating

Accelerometer

Acceleration response

Identification of the 1st frequency

Estimation of strength based on pushover curve

Model updating

Re-use limitation

Safety limitation

The index for supporting decision making

Conclusions: 1)The method of estimating the decrease of stiffness and the deterioration of strength based on structural health monitoring techniques was proposed. 2) The numerical model including the deterioration behavior was verified to be able to simulate the test result. 3)The index estimated from fragility function and aftershock hazard can be applied for the decision-making on re-use and safety limitations. 4) The framework for immediate decision support system based on structural health monitoring and the index assessed by failure probability with respect to aftershock is proposed.