C10

Identification and Characteristic Study of Damping Coefficient for Passive Control Systems

○Feng ZHAO, Masayoshi NAKASHIMA

Following the major recent earthquakes, especially those of Northridge, California, US in 1994 and Kobe, Japan in 1995, the earthquake engineering community expects the buildings to achieve significantly higher performance than below. In order to raise seismic performance levels while keeping construction costs reasonable, passive supplemental damping systems have gained acceptance and are widely implemented in hundreds of buildings around world. However, because the history of passive damping systems is short, the technology has never been attested under very large earthquakes.

In order to validate the reliability of passive damping systems by realistic simulations before such earthquakes would occur, a full scale five-story building specimens with four types of dampers was examined using the E-Defense in Japan. The four types of dampers are buckling restraint braces, oil dampers, viscous dampers, and visco-elastic dampers.

Figure.1 Specimen Building

This presentation introduces a general method to estimate the equivalent story damping coefficient C_s using the experiment data for the oil, viscous, and visco-elastic dampers. This method uses a least square method based on the governing equation of motion and with the assumption of the full stiffness matrix.

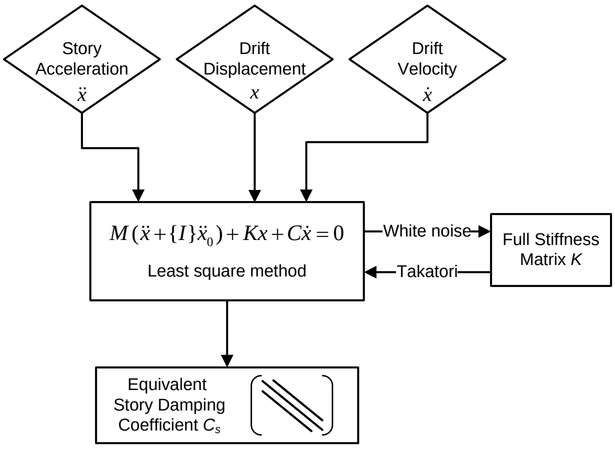

Figure.2 Procedure for Estimating C_s

The accuracy of this method is validated via numerical simulations of a five-DOF shear stick model and 2D frame model before applied to experiment data.

The equivalent story damping coefficients for the oil, viscous and visco-elastic dampers under different scales of the Takatori earthquake ground motion were investigated. Only the viscous damper shows amplitude-dependent behavior for the story damping coefficient, while the other two types of dampers keep constant for different scales of the Takatori motion.

Correlation between the internal individual damping coefficient C_d and the equivalent damping coefficient C_m for each damper are also estimated from the experiment data. The correlation is found to be reasonable. The internal individual damping coefficient C_d estimated by tests on dampers only and obtained from the frame test are very close to each other.