

Structural Identification using Adaptive Monte Carlo Filter

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1. Introduction

Structural identification techniques using Kalman filter or Monte Carlo filter have been gradually developed in some useful form to solve many problems in health monitoring of civil structures. In our study, adaptive Monte Carlo filter that considers the effect of process noise of observed response and extended Kalman filter techniques are applied to identify dynamic characteristics of a five stories model structure with rubber bearings at the corners of each layer using the observed data from shaking table test.

2. Structural Identification

We measured dynamic responses of the five stories model structure with rubber bearings at the corners of each layer as shown in Fig.1. The shear building model of five degree of freedom as shown in Fig.1 is used for identification of the structure. The identified time histories of stiffness and damping coefficient of each layer are shown in Fig.2. In this Figure, stiffness and damping coefficient values of each layer are converged to similar values. The identification values of stiffness and damping coefficient are estimated as mean value after 20 seconds from start of time histories as shown in Fig.2. Using identified stiffness values and damping ratio of 0.02, we re-simulated the structural response of the fifth mass of the analytical model with the input values as acceleration on the surface of shaking table as shown in Fig.3. Amplitudes of re-simulated response are little bit different from observed ones but both phases agree well.

3. Conclusion

Using the dynamic responses from shaking table test, structural identification was conducted for the

five stories model structure with rubber bearings at the corners of each layer. Re-simulated responses were well agreed with observed responses.

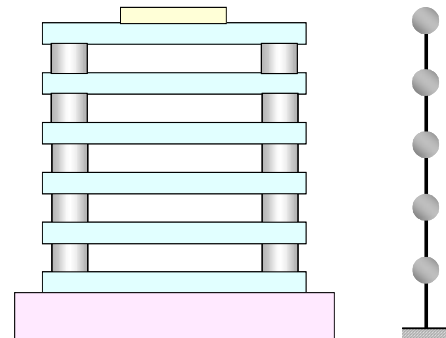


Figure 1. A five stories model structure

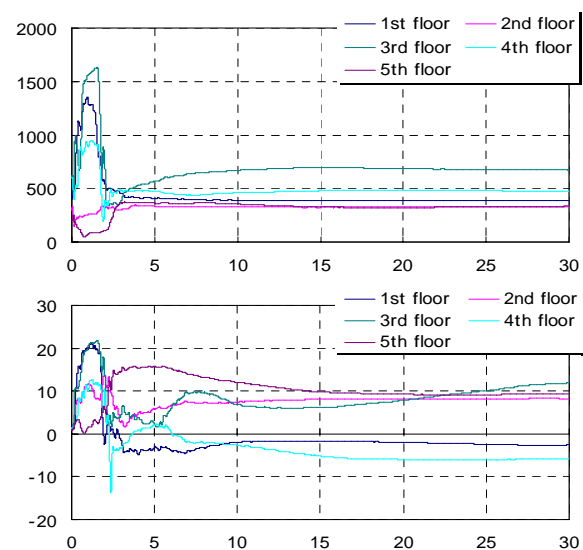


Figure 2. Identification of stiffness (upper) and damping coefficient (lower)

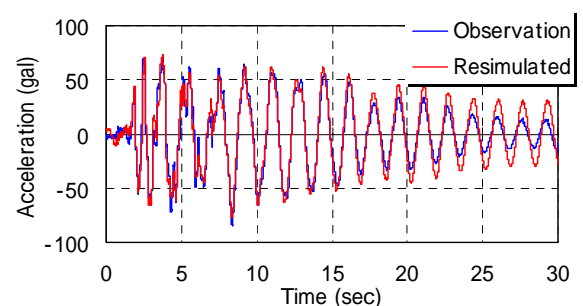


Figure 3. Comparison of re-simulated and observed responses