ABSTRACTS (MASTER THESIS)

Estimation of relative displacement of wooden buildings calculated from acceleration using wavelet transform

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Introduction

A technique has been proposed for calculating the relative displacement of each floor acceleration and for automatically determining the residual seismic performance of a building damaged by earthquakes. In this study, in order to apply this technology to wooden buildings, analysis was performed based on the data obtained by the full scale shaking table test.

Analysis method

The relative displacement of each floor is calculated from the acceleration record measured at each floor in the full-scale shaking table experiment by double integral. At this time, since the measurement error such as the baseline deviation included in the acceleration recording increases by integration, the calculated relative displacement does not correspond to the measured displacement. Therefore, the acceleration recording is decomposed into nine components with different frequencies using wavelet transform, and only the main components are selected and added to calculate the displacement from which the measurement error is removed. In this method, the selection of the main components is the main point of analysis accuracy, so the component selection method was examined based on the experimental data of the wooden frame specimen of one story buildings and two story buildings. The calculated displacement (hereinafter, referred to as analysis value) was compared with the displacement actually measured by the displacement meter (hereinafter, referred to as measured value) to evaluate its accuracy. In addition, for the purpose of application to CLT buildings, analysis was conducted using experimental results of two- and five-story CLT specimens.

Consideration and conclusion

In the main component selection, in the previous research, the method of selecting from the transfer function of the analysis floor and the upper floor and the absolute response acceleration-relative displacement relationship of each component was used. When this method was applied to a wooden frame specimen, the average value of the correlation coefficient between the analysis value and the time history waveform of the measured value was 0.864, and the average value of the maximum displacement consistency rate was 0.850. At this time, there were some of data in which the main component could not be selected sufficiently. Therefore, in addition to the component selected by this method, when the component which is superior in the response acceleration Fourier spectrum is selected, the average value of the correlation coefficient can be improved to 0.919 and the average value of the matching rate of the maximum displacement to 0.888.
When the above method was applied to two CLT test specimens, sufficient accuracy could not be confirmed. This result can be considered to be caused by the rocking behavior in the two-story specimen and by the torsional behavior in the five-story specimen. Therefore, we examined a method of calculating relative displacement with higher accuracy by removing these effects.