

Progressive Construction of Hysteresis Models for Woodframe Houses with Visco-Elastic Structural Control Devices

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In assessing structural safety of wooden structures by seismic response analyses, it becomes important to express the nonlinear characteristics of structures systematically that cover a wide range of deformations. Woodframe structures are composed of various elements such as beam-column, braces, shear wall panels, structural control devices and so on. It is desirable to construct the overall nonlinear characteristics of wooden houses with taking into account the hysteretic characteristics of the individual elements. Though some hysteretic models applicable to wooden houses have been proposed, the method to construct systematically the hysteretic characteristics of structures on the basis of nonlinear characteristic of each element including visco-elastic structural control devices has not been presented.

The objective of the study is to present a method to construct the nonlinear characteristics of woodframe houses with visco-elastic structural control devices on basis of hysteretic characteristic of each element, which are determined by pseudo dynamic tests. A series of pseudo-dynamic tests of woodframe house models with and without braces or visco-elastic structural control devices have been conducted. Confirming applicability of the law of superposition for stiffness, the hysteretic characteristic of each element has been extracted. It is shown that the nonlinear characteristics, which are characterized by spindle-shaped and strong slip behavior, can be expressed by combining two types of Bouc-Wen models. The method is characterized by systematic and uniform manners for construction of the hysteretic characteristics based on the respective elements.

The effectiveness and applicability of the composed nonlinear characteristics for woodframe houses are validated by comparing the analytically evaluated responses with experimental results conducted by use of shaking table tests. It was also discussed the effectiveness of the visco-elastic structural control device in reducing the seismic response of the woodframe houses.