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A Building-specific Bi-directional Dynamic Loading Protocol for Experiments of Non-structural Components

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Abstract. Experimental research on the seismic performance of non-structural components in China is still very limited, especially for those sensitive to multiple engineering demanding parameters. Inspired by the Non-structural Component Simulator at the University at Buffalo (UB-NCS), a similar simulator is being developed at the Institute of Engineering Mechanics (IEM) at Beijing, China, which aims at providing a general-purpose test bed that simulates the simultaneous motions of the floor and ceiling of a full-scale room of various occupancies hosted in different types of buildings. Unlike the UB-NCS which utilizes dynamic actuators for loading, the IEM-NCS will be based on an 5m by 5m shake table and incorporates sub-structure shake table testing technique to enable the simulation of floor motions that exceed the capacity of the table. To fully exploit the flexibility of the simulator, the dynamic loading protocol previously developed for UB-NCS is modified primarily in the following aspects: (1) the random vibration process for determining the height-wise floor acceleration and inter-story drift distribution is replaced by a nonlinear time-history analysis of the building of concern subjected to a suite of selected earthquake ground motions; (2) the α–function in the UB-NCS protocol is modified to match floor response spectra; (3) a bi-directional loading rule is introduced taking advantage of the shake table.

Keywords: Acceleration-sensative, Displacement-sensative, Shake table test, Floor response spectrum, Bi-directional loading.

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