

Motion Analysis of Furniture using FEM

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Improperly secured furniture, especially on the upper floors of high-rise buildings under long-period ground motion, can become dangerous objects for human life. Many tumbled furniture such as chairs and tables in schools could become fatal obstacles that prevent children from evacuating. In this research, an effective numerical code to analyze the motion behaviors of furniture subjected to seismic excitations was developed. The numerical code is constituted based upon the adaptively shifted integration (ASI) – Gauss technique, which is a finite element scheme that provides higher computational efficiency than the conventional code. The frictional contact between objects was fully considered by employing a sophisticated penalty method. We carried out some excitation tests of furniture on a shake-table, where steel cabinets were excited by sine wave and the displacement data were recorded by a motion capture system. We validated the numerical results by comparing with the vibration test results.

Keywords: Motion analysis, Furniture, Finite element method, Shake-table test