# Traditional Five-Story Pagoda: Experimental Analysis Using Home-Brew Seismic Generator

Nagano, Miyabi (School: National Institute of Technology, Gifu College)

The five-story pagodas in Japanese ancient times have never been collapsed by earthquakes for 1,300 years. Therefore, they are highly earthquake resistant. Elucidation of this earthquake-resistant mechanism may lead to the improvement of earthquake resistance technology. The existing 22 five-story pagodas are designated as the national treasures or important cultural assets. It is not allowed to give them strong vibrations. Therefore, I made an experimental model of the five-story pagodas, which has the similar ratio of prop width, story height, and weight of each story, to the real ones. We can apply big vibrations so that it can collapse, which clarifies its vibration behaviors and confirms its earthquake resistance. I developed a “seismic-generator” which can reproduce the actual earthquake waveforms by using the seismograph data released by Japan Meteorological Agency. For simplicity, I focused on horizontal one-dimensional movements, which I believe can fairly clarify the behaviors. Using this equipment, we conducted shaking table tests for the 1/70 scale model which I produced, and analyzed its behaviors by video. The conditions of the model are presence/absence of ”Shin-bashira (center-pillar)” and roof weights. The experiments clarified the followings; 1)the swing of each layer of the 2-fulcrum "balancing-toy" attenuates the vibration, 2)each layer is independent of each other, and it floats up, so the pagoda is never collapsed by strong earthquake shake, and 3)“Shin-bashira” plays a role in a tilt limiter, and rolling doesn’t occur in the floating. The flexible resistance to earthquakes of five-story pagodas may be applied to future seismic designs.

**Awards Won:**