Earthquake Simulator Experiments of a Generation IV Pebble Bed Reactor Model

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Abstract

One Generation IV reactor uses circulating buoyant pebbles as fuel, molten salt as coolant, and graphite as moderator. Future seismic design of such reactors may rely on numerical models that are capable of capturing the interactions of the liquid coolant with the enclosing and buoyant structural components. As part of an ARPA-E project, experiments on a scaled model involving representations of fuel pebbles, graphite reflector blocks, core barrel, vessel, and pebble handling and coolant circulating equipment atop the vessel head are underway at the University at Buffalo. The effects of seismic isolation in reducing accelerations and deformations in different components are being studied using Friction Pendulum isolators installed under the base of the vessel. The response quantities of interest are the hydrodynamic pressures on the vessel, the acceleration and strain response of the core barrel, the dynamic movement of the buoyant reflector blocks, potential for pebble packing consolidation under shaking, and the strain and acceleration behavior of the head-mounted components. The data generated from the tests will be used for validation of numerical models for fluid-structure interaction in finite element codes and in identifying the benefits of seismic isolation on the response of equipment in advanced reactors.