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SEISMIC SLOSHING EFFECTS IN LEAD-COOLED FAST REACTORS

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Pool-type configuration of LFR (lead-cooled fast reactor) primary systems allows for simple and economic reactor design solutions. However, partially-filled heavy liquid pools pose seismic safety concerns related to sloshing. Violent sloshing can lead to structural failures, gas entrapment and potential core voiding. Seismic isolation systems are used to reduce the mechanical stresses in structures, but its effect on sloshing must be clarified.
This paper describes a numerical CFD (computational fluid dynamics) study of lead sloshing in ELSY reactor. The motion of free surface is modeled using a VOF (volume of fluid) method. A fixed base reactor and seismically isolated reactor cases are modeled using synthetic earthquake data produced in SILER project. Verification and validation of the numerical model is presented.
The adverse effects of seismic isolation system in terms of sloshing-induced hydrodynamic loads and gas entrapment are demonstrated. Furthermore, influence of geometry on sloshing behavior has been discussed. A mitigation solution using flow restrictions is proposed and analyzed.

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