Hydrodynamic Ram Simulations of Thin-walled Liquid-filled 7 L and 15000 L Containers

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When liquid-filled containers are impacted by projectiles moving at high speed, the transfer of kinetic energy can cause container failure and release of the liquid. The hydrodynamic ram (HRAM) of a container is a coupled fluid dynamics and structural dynamics problem that is an important consideration for failure of fuel tanks in aircraft and ground vehicles. We present peridynamics HRAM simulation results of container response and liquid spray. We consider response of seven liter (two gallon) and ~15000 liter (4000 gallon) thin-walled steel containers subject to fragment impacts. Experimental data of the spray pattern and container shape are available for 7 L containers and compare well with simulation results. The results demonstrate the ability of peridynamics simulations to capture HRAM effects on containers. Two applications of the work are better understanding of fuel tank structural damage and fire risk to vehicles.

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