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Simulation of structural failure from contact underwater explosions

A numerical method for performing large-deformation two-way coupled fluid-structure interaction simulations has been developed to model a wide class of problems in which structural response significantly influences subsequent fluid flow, through motion-induced cavitation, structural failure or both. We demonstrate the suitability of the approach to such events by applying our method to the early-time response of plates to contact and near-contact underwater explosions in three dimensions. The plates exhibit a variety of behaviors including petalling failure with venting of explosive products through the resulting holed plates. The deformation and failure patterns of the plates are compared with experimental data from trials performed by Defense Research Development Canada at Suffield.