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Crossing the boundary: numerical investigation of water entry conditions[1] DIONYSIOS ANGELIDIS, FOTIS SOTIROPOULOS, Department of Civil Engineering, College of Engineering and Applied Sciences, Stony Brook University, Stony Brook, New York 11794, USA — Several engineering and scientific applications involve water impact problems. To accurately capture the dynamics of the cavity formation and the water ejected as a body hits the water, the formidable range of temporal and spatial scales should accurately be resolved with affordable computational cost. We have enhanced the potential of the two-phase flow version of the immersed-boundary adaptive mesh refinement flow solver, developed by our group, to perform high-fidelity two-phase flow calculations on locally refined grids. We employ a level-set method and tackle the computational challenges arise during the explicit solution of a mass-conserving reinitialization equation. In contrast to conventional approaches, we propose a convergence criterion which enables the number of iterations to be self-adjusted based on the values of the distance function. The efficiency of our method is demonstrated by performing two-phase flow calculations including the high-speed water entry of a V-shaped wedge. Our results are found to be in good agreement with experimental measurements and enable us to gain insight into the instability that arises on the onset of the closure phase of the cavity.

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