Supplemental Material for
Asynchronous Eulerian Liquid Simulation

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This supplemental material provides additional results regarding interactions with static solids (Figure 1 and Figure 2), the specific configuration where a region is completely surrounded by liquid/solid boundaries (Figure 3), a PDE-based approach for re-distancing level set (Figure 4), and an overview of our extrapolation (Figure 5). For brevity of exposition, below we provide only the Figures and captions. Corresponding animations are provided in the supplemental video.

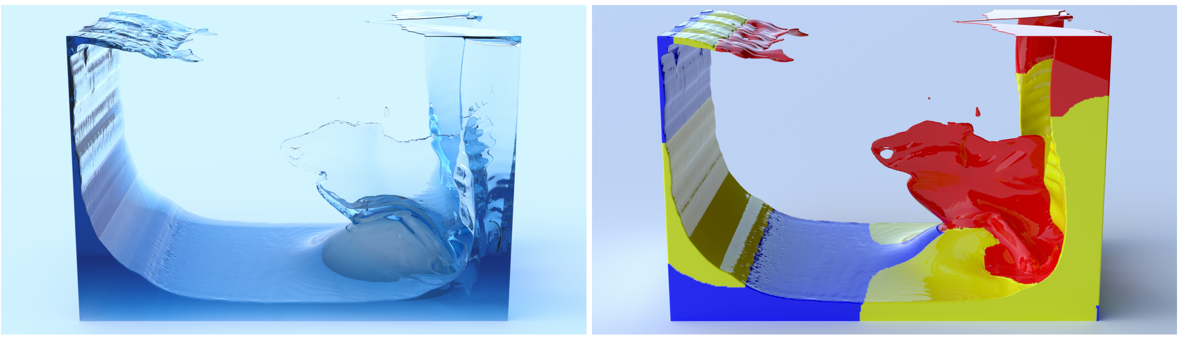

Figure 1: Breaking dam with a hemispherical solid obstacle. An Intel(R) Core(TM) i9-7920X CPU @ 2.90GHz, 12 cores, 24 threads 128GB machine. 384 × 256 × 256 resolutions. One video frame corresponds to 1/60 seconds in the real time scale. Red, yellow, and blue colors represents level 0, level 1, and level 2. Compute time: 77.33 seconds per frame. Speed-up gain was up to 2.70 and 1.70 on average. As mentioned in the main paper, only an extension needed to support static solids is a velocity extrapolation into the solid.

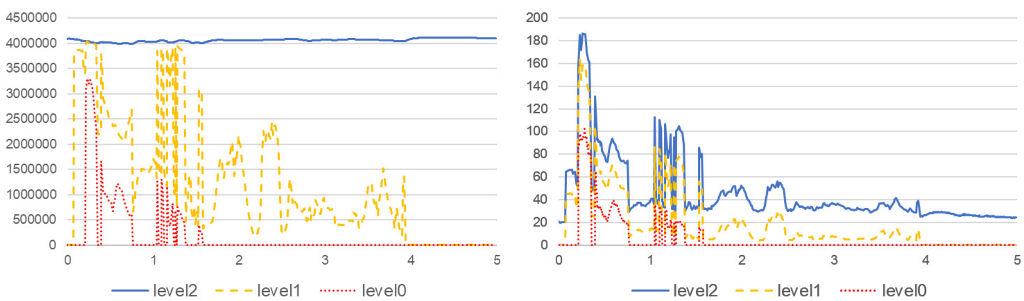

Figure 2: Performance breakdown of Figure 1. Left shows cell count, and right shows the simulation time per level to advance Δt_m. When the number of levels is only 2, yellow represents level 0 and blue 1. Likewise, when there exist only level 0, blue represents level 0

Figure 3: Water drops on a vertically long cubical tank. Initial state (left), and (approximately) $t = 1$ second (right). $128 \times 384 \times 128$ grid resolutions. The regions are horizontally divided. From top to bottom, we set level 0, 1, 0, respectively. The bottom region does not have air/liquid boundaries, but our method works without artifacts.

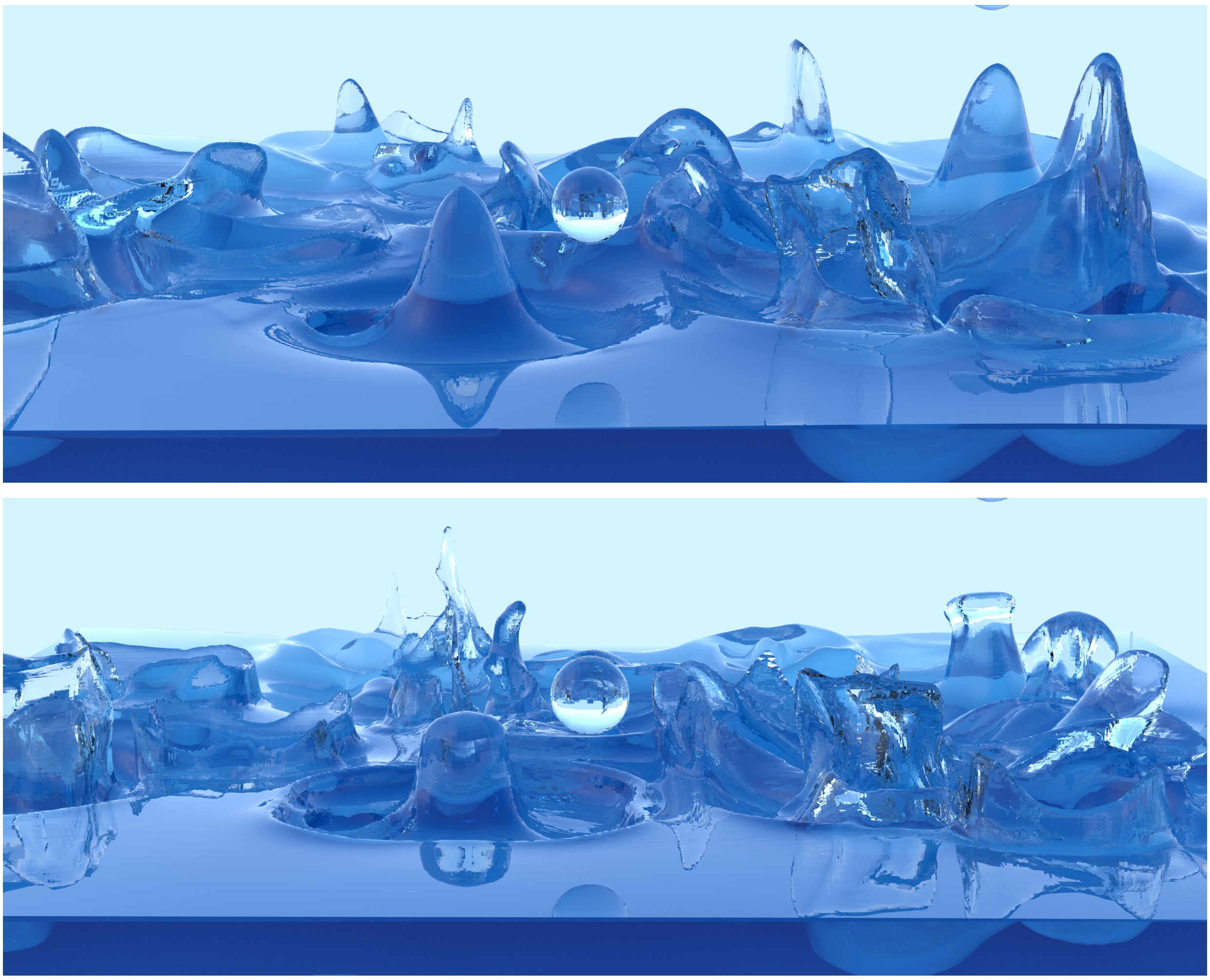

Figure 4: Pouring Rain with a PDE-based re-distancing of level set. Synchronous result (top), and asynchronous result (bottom). $384 \times 192 \times 384$ grid resolutions. The use of a PDE-based level set re-distancing instead of the Fast Marching method reduces grid aligned artifacts on both time integrators. We also find that results are qualitatively better improved on the synchronous time integrator.

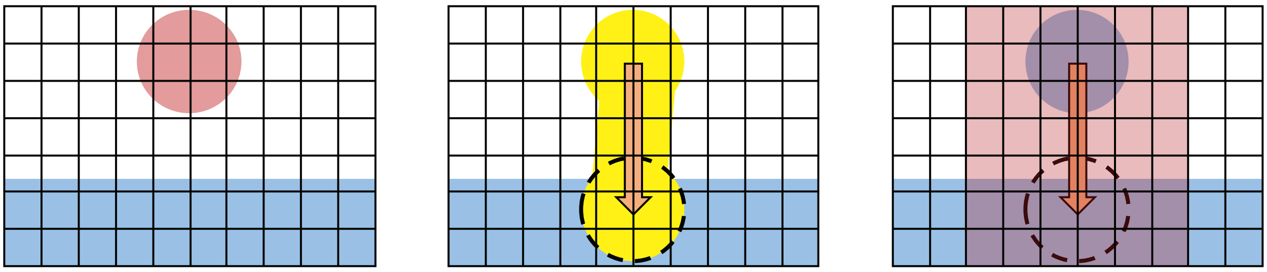

Figure 5: Extrapolation of cells. We first rasterize all the cells marked as fluid for a target level (red, left). Next, we advect the cells forward in time and rasterize all the cells along the trajectory (yellow, middle). Finally, we extrapolate the cells 6 cells wide (transparent red, right).