Analysis of my Object Fusion Implementation

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Approach

The approach I took to implement object fusion was to store the minimum distance between bodies per time-step, as the distances between all bodies must be calculated once already in order to calculate the force between them. By storing this minimum distance variable, the distances between bodies only need to be recalculated if the minimum distance is less than 1e-2, shortening run-times.

When the bodies do fuse, I decrement the `NumberOfBodies` variable, sum the masses and calculated the fused velocity and position by a weighted mean. I store the fused particle in the array at the smaller index of the two merging bodies and move the body at the end of the array – now out of range – into the larger of the indices. In this way, no bodies are lost when merging.

Results

To study the impact of time-step size on the position of the collisions, I varied the time-step sizes and calculated the difference in the position of the collisions. Figure 1 is the log-log plot of time-step size and the difference in position. Figure 1 clearly shows that the difference converges as the graph tends a limit, as time-step size grow smaller.

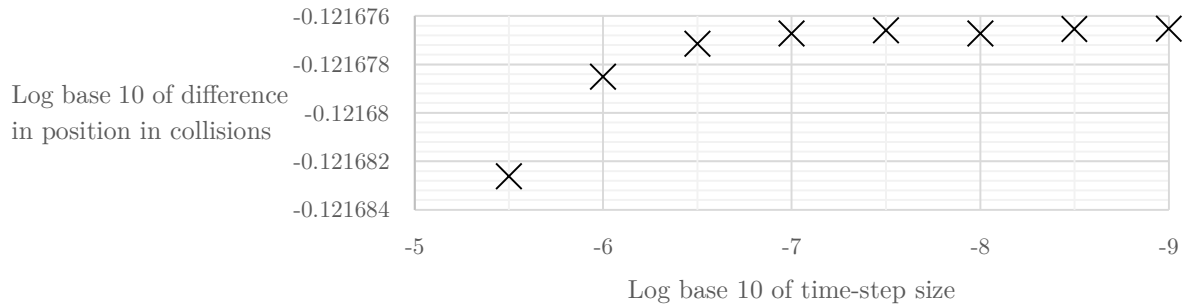

Figure 1: Log-log plot of time-step size against difference in position of collisions

The order of convergence can be derived from the plot of time-step size against distance (Figure 2). From this plot it is clear to see that the convergence order of the method is linear.

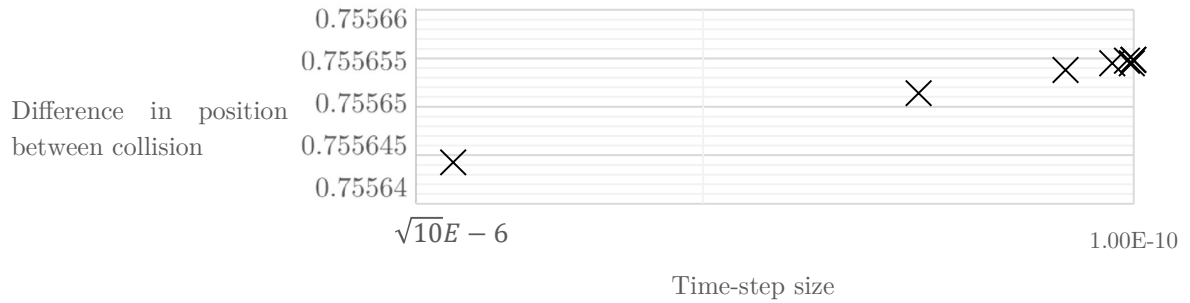

Figure 2: Plot of time-step size against difference in position of collisions.