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OPEN BOUNDARY CONDITIONS WITHOUT BUFFER ZONE FOR INCOMPRESSIBLE SMOOTHED PARTICLE HYDRODYNAMICS

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Open Boundary conditions are challenging in Smoothed Particle Hydrodynamics (SPH). Several methods are introduced in the last years using a buffer zone at the boundary to correct the particle deficit. In contrast to weakly compressible SPH (WCSPH), where a buffer zone results in stable open boundary conditions, it only shifts the problem in truly incompressible SPH (ISPH). In ISPH, consistent boundary conditions for the pressure poisson equation are necessary at any boundary.
The ghost particle technique was introduced for solid wall boundary conditions [1]. We extended this technique in combination with the mirror particle technique [2] to open boundary conditions. Now, it is possible to deal with different numbers and sizes of in- and outlets. Furthermore, different combinations of velocity and pressure boundary conditions are possible.
We validated the boundary condition with selected test cases. One test case is a Stokes flow around a cylinder. The results are in good agreement with finite volume simulations. Another example is a poiseuille flow where not only the velocity profile but also the pressure drop is compared to an analytical solution. We again found good agreement. We consider all test cases for different Reynolds numbers and resolution to shown grid convergence.

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