

## The past and future of solid boundary treatment in SPH

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### ABSTRACT

In this paper, we analyzed various solid boundary treatment methods developed in Smoothed Particle Hydrodynamics (SPH) and proposed requirements for new boundary treatment techniques. The particle inconsistency problem near solid boundaries has been one of the major issues to address since SPH was employed to analyze fluid flow. The introduction of the virtual particle method, one of the earliest approaches, significantly improved result accuracy by simply placing particles outside the fluid domain. This method has been evolving since the early days of SPH research, with recent developments incorporating dynamic virtual particles that assign physical properties to these particles. However, as boundary treatment techniques became more sophisticated, improvement in computational efficiency stagnated. Subsequently, the analytical boundary condition method, which calculates boundary terms without interaction between virtual particles, was proposed. This method showed some improvement in computational efficiency, but issues with complex procedures and compatibility with other numerical techniques remained. Analyzing existing boundary treatment methods revealed that future boundary treatment techniques need to be simple and produce accurate results without additional placement of virtual particles or loop algorithms to advance both accuracy and computational efficiency.

### REFERENCES

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