A Particle-Particle Collision Model for Smoothed Profile Method
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Iowa — Smoothed Profile Method (SPM) is a type of continuous forcing approach
that adds the particles to the fluid using a forcing. The fluid-structure interaction
is through a diffuse interface which avoids sudden transition from solid to fluid.
The SPM simulation as a monolithic approach uses an indicator function field in
the whole domain based on the distance from each particle's boundary where the
possible particle-particle interaction can occur. A soft sphere potential based on
the indicator function field has been defined to add an artificial pressure to the flow
pressure in the potential overlapping regions. Thus, a repulsion force is obtained
to avoid overlapping. Study of two particles which impulsively start moving in an
initially uniform flow shows that the particle in the wake of the other one will have
less acceleration leading to frequent collisions. Various Reynolds numbers and initial
distances have been chosen to test the robustness of the method. Study of Drafting-
Kissing Tumbling of two cylindrical particles shows a deviation from the benchmarks
due to lack of rotation modeling. The method is shown to be accurate enough for
simulating particle-particle collision and can easily be extended for particle-wall
modeling and for non-spherical particles.

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