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Study of the Vortex Rings Interaction by 3d Vorticity Particle-In-Cell Method

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In paper it was presented numerical investigation of the vortex rings interaction. It was studied the leap-frogging phenomenon for inviscid flow. It was shown that dynamics of the vortex rings is very sensitive to the initial parameters like diameters of the rings, their mutual positions and circulations. It was studied also the reconnection of the vortex rings in viscous flow. The vorticity particle-in-cell method for three-dimensional, viscous flow was used. Equations of motion were formulated in the terms of vector potential and vorticity. A viscous splitting algorithm was applied. The viscous effect was taken into account by the particle strength exchange method. While solving of the Euler equation the invariants of the motion like kinetic energy, enstrophy and helicity were controlled. It was also controlled the divergence of the vorticity, velocity and vector potential fields. Agreement of numerical results with the experimental data was very good.

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