FM6S_12565

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Simulation of a Viscous Flow Past a Three Dimensional Obstacle Using Vortex Particles

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The new formulation of the lagrangian vortex method for viscous flow simulations is presented.The vorticity field is approximated by the large ensemble of vortex particles. These objects move with the fluid and perform the random motion modeling diffusion of the vorticity. The contribution of each particle to the vorticity field is exactly divergence-free. The no-slip boundary condition is ensured by auxiliary potential components and the vortex induction. At each time, two classes of the particles exist: those created in the past and the new particles introduced on the boundary to cancel tangent component of the velocity. Details of the method, the numerical implementation and sample results concerning the velocity and vorticity patterns, aerodynamics forces and pressure field are presented.

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