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SEMI-ANALYTICAL INFLUENCE COMPUTATION FOR VORTEX SHEET WITH PIECEWISE CONSTANT INTENSITY DISTRIBUTION IN 3D VORTEX METHODS

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The original numerical scheme is developed for vortex sheet intensity computation for 3D incompressible flow simulation using meshless Lagrangian vortex methods. It is based on boundary condition satisfaction for tangential components of the velocity on the body surface instead of widespread condition for normal components. For the body triangulated surface the corresponding integral equation is approximated by the system of linear algebraic equations, which dimension is doubled number of triangular panels. Vortex layer intensity on the panels assumed to be piecewise-constant.

The coefficients of the matrix are expressed through double integrals over the pairs of panels. When these panels have common edge or common vertex these integrals become improper. In order to compute them it is necessary to exclude the singularities, i. e., to split the integrals into regular and singular parts. Regular parts are expressed through integrals of smooth bounded functions, so they can be integrated numerically with high precision by using Gaussian quadrature formulae. For singular parts exact analytical integration formulae are derived.

The developed approach allows to raise significantly the accuracy of vortex layer intensity computation in vortex method for flow simulation around arbitrary 3D bodies and use arbitrary triangular mesh on body surface including mesh refinement near sharp edges, what is especially important for flow simulation around bodies with complicated geometry.

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