# NUMERICAL MODELING OF INTERACTION OF VORTEX STRUCTURES IN FLUIDS AND PLASMAS

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The results of numerical modeling of interaction of the vortex structures in a continuum, and, specifically, in fluids and plasmas in 2D approach, when the Euler-type equations are valid, are presented. The equations' set $e_i \, \mathrm{d}_t \, x_i = \partial_{y_i} \mathrm{H}/B$, $e_i \, \mathrm{d}_t \, y_i = -\partial_{x_i} \mathrm{H}/B$, $\partial_t \rho + \mathbf{v} \cdot \nabla \rho = 0$, $\mathbf{v} = -(\hat{\mathbf{z}} \times \nabla \psi)/B$, $\Delta \psi = -\rho$ describing the continuum or quasi-particles with Coulomb interaction models [1], where $\rho$ is a vorticity or charge density and $\psi$ is a stream function or potential for inviscid fluid and guiding-centre plasma, respectively, and $\mathrm{H}$ is the Hamiltonian, was considered. For numerical simulation the CD method specially modified was used. The results showed that for some conditions the interaction is nontrivial and can lead to formation of complex forms of vorticity regions, such as the vorticity filaments and sheets, and also can ended to formation of the turbulent field. The theoretical explanation of the effects is given on the basis of the generalized critical parameter which determines qualitative character of interaction. We investigated the applications to dynamics of vortex structures in the atmosphere, hydrosphere and plasma, namely: evolution of the cyclonic type synoptic and ocean vortices, and interactions in the vortex-dust particles system, and also dynamics of streams of charged particles in a uniform magnetic field. Our approach may be useful for the interpretation of effects associated with turbulent processes in fluids and plasmas.

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## References

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