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## Critical parameters at the interaction of vortical structures in a fluid

One of the main problems in the investigation of the dynamics of the vortex structures is a study of a character of their interaction and in particular, a search of states when a system of the vortices conserves its stability. In this connection, it is important to have a possibility of prediction of the result of the evolution of vortices outgoing from the parameters which describe the initial state of the system. On the basis of processing of the results of numerical simulations of the evolution of the system of the finite area vortex regions (FAVRs), we introduce a special generalized parameter which enables us to predict the qualitative character of the interaction of the FAVRs. Thus, for a pair of the FAVRs, we managed to find the function $\xi$ having the sense of critical parameter which uniquely determinates a qualitative character of their interaction. Comparing the value of $\xi$ with its critical value $\xi_{cr}$ we can predict the result of interaction of the vortex regions, namely: if $< \xi_{cr}$ then "phase intermixing" of FAVRs will not be observed with evolution, in the opposite case, when $\xi \leq \xi_{cr}$ the merging of vortices with further formation of the vorticities of more small scales will be happen. For the vortices of the circle and elliptical (or close to elliptical) form, the value of the generalized critical parameter $\xi_{cr}=2.129$ corresponds to the "phase change" point. The obtained results can be useful on studying the stability of vortex structures of different types and origins, including vortices in a plasma (especially in space plasma and in particular, in the problems associated with the vortex movements in the dusty plasma) and in a fluid (for example, the quasi-geostrophic vortices in atmosphere and ocean).

### Biography

Vasily Yu Belashov, PhD (Radiophysics), DSci (Physics and Mathematics). Main fields: Theory and numerical simulation of the dynamics of multidimensional nonlinear waves, solitons and vortex structures in plasmas and other dispersive media. Presently, he is Chief Scientist and Professor at the Kazan Federal University. He was Coordinator of studies on the International Program "Solar Terminator" (1987-1992) and took part in the International Programs WITS/WAGS and STEP. He is the author of 320 publications including 7 monographs. Main books: Solitary Waves in Dispersive Complex Media. Theory, Simulation, Applications. Springer-Verlag GmbH, 2005; Solitons: Theory, Simulation, Applications. Kazan, Kazan Federal University, 2016.

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