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Eulerian–Lagrangian Analysis of Navier–Stokes Turbulence

Koji Ohkitani[(1)], Peter Constantin[(2)]

(1) *RIMS, Kyoto University, Kyoto, Japan*
(2) *Department of Mathematics, The University of Chicago, Chicago, USA*

A numerical study of Navier–Stokes turbulence is performed on the basis of Eulerian-Lagrangian formalism. This is a form of impulse formalisms augmented with viscous Weber formula. As in the case of previous numerical experiments on reconnecting vortices, the diffusive Lagrangian label requires resetting to keep its Jacobian matrix invertible. Associated with this near identity transformation of the label, a time scale is defined as resetting intervals. It is found to be at least as fast as Kolomogorov's time scale. Virtual velocity is a counterpart to initial velocity in inviscid Weber formula. It has two kinds of viscous terms in its time evolution; a diffusion term and a term related with geometrical property of particle paths. Using the latter connection term, a characterization is proposed as to the singular perturbation nature in the limit of vanishing viscosity.

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