3D Navier-Stokes and Euler Equations with Initial Data Characterized by Uniformly Large Vorticity

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We prove existence on infinite time intervals of regular solutions to the 3D Navier-Stokes Equations for fully three-dimensional initial data characterized by uniformly large vorticity; smoothness assumptions for initial data are the same as in local existence theorems. The global existence is proven using techniques of fast singular oscillating limits and the Littlewood-Paley dyadic decomposition. Infinite time regularity is obtained by bootstrapping from global regularity of the limit equations. For such a class of initial data characterized by weak alignment of initial vorticity we resolve one of the problems raised by J. Leray: find classes of 3D initial conditions for which weak 3D solutions become strong solutions after a finite time interval. Algebraic geometry of resonant Poincare curves is also used to obtain regularity results in generic cases for solutions of 3D Euler Equations with initial data characterized by uniformly large vorticity.

References:

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