VORTEX FILAMENTS IN THE 3D NAVIER-STOKES EQUATIONS

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We consider solutions of the Navier-Stokes equations in 3d with vortex filament initial data of arbitrary circulation, that is, initial vorticity given by a divergence-free vector-valued measure of arbitrary mass supported on a smooth curve. First, we prove global well-posedness for perturbations of the Oseen vortex column in scaling-critical spaces. Second, we prove local well-posedness (in a sense to be made precise) when the filament is a smooth, closed, non-self-intersecting curve. Besides their physical interest as a model for the coherent vortex filament structures observed in 3d fluids, these results are the first to give well-posedness in a neighborhood of large self-similar solutions of 3d Navier-Stokes, as well as solutions which are locally approximately self-similar. Joint work with Pierre Germain and Benjamin Harrop-Griffiths.