

Large time behavior of the vorticity of 2D viscous flow and vortex formation in 3D flow

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Abstract. We consider an initial value problem for the two-dimensional vorticity equation and show that the solution $\omega(\mathbf{x}, t)$ tends to Oseen's diffusing vortex at large times keeping the same total vorticity. No particular structure of the initial distribution $\omega(\mathbf{x}, 0)$ is assumed except the restriction that $R = (1/\nu) \int |(\mathbf{x}, 0)| d^2\mathbf{x}$ is small. Applying a time-dependent scale transformation, we show the asymptotic stability of the Burgers' steady vortex. Physically this implies formation of a concentrated cylindrical vortex.