On the Optimal Rate of Vortex Stretching for Axisymmetric Euler Flows without Swirl

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Abstract

We consider incompressible Euler flows with axisymmetry and without swirl. In $\mathbb{R}^3$, we prove the $t^{4/3}$-upper bound for the growth of the vorticity maximum. This was conjectured by Childress [1] and supported by numerical computations from Childress—Gilbert—Valiant [2]. The key idea is to estimate the velocity maximum by the kinetic energy and conserved quantities related to the vorticity. This is a joint work with In-Jee Jeong (SNU) [3].

References

[1] Stephen Childress. Growth of anti-parallel vorticity in Euler flows. *Phys. D*, 237(14-17):1921–1925, 2008.

[2] Stephen Childress, Andrew D. Gilbert, and Paul Valiant. Eroding dipoles and vorticity growth for Euler flows in $\mathbb{R}^3$: axisymmetric flow without swirl. *J. Fluid Mech.*, 805:1–30, 2016.

[3] Deokwoo Lim and In-Jee Jeong. On the optimal rate of vortex stretching for axisymmetric Euler flows without swirl. *Arch. Ration. Mech. Anal.*, 249(32), 2025.