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A Circulation Constraint on Enstrophy Growth in 3D Euler[1]
ROBERT M. KERR, University of Warwick, MIGUEL BUSTAMANTE, University College Dublin — It is shown that by careful consideration of circulation conservation in simulations of anti-parallel Euler vortices how one can discriminate between clean, potentially singular calculations and contaminated, non-singular results. For the latest case with singular behavior it is shown empirically that non-viscous enstrophy growth is consistent with the rigorous upper bound for enstrophy growth for the viscous Navier-Stokes equation, if one replaces viscosity with circulation in the argument. The new scaling laws are consistent with the older numerics presented by Kerr (1993), but many of the conclusions of the old analysis require modification. Besides a new power law for enstrophy growth, if the growth of the maximum of vorticity obeys $\|\omega\|_\infty \sim (T_c - t)^{-\gamma}$, then we find that $\gamma > 1$ and that $\gamma \equiv 1$ as previously reported is unlikely.

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Robert M. Kerr
University of Warwick

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