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Title: Enhanced dissipation and hypoellipticity in shear flows

Authors: Jacob Bedrossian and Michele Coti Zelati

Abstract: We analyze the decay and instant regularization properties of the evolution semigroups generated by two-dimensional drift-diffusion equations in which the scalar is advected by a shear flow and dissipated by full or partial diffusion. We consider both the case of space-periodic and the case of a bounded channel with no-flux boundary conditions. In the infinite Péclet number limit, our work quantifies the enhanced dissipation effect due to the shear. We also obtain hypoelliptic regularization, showing that solutions are instantly Gevrey regular even with only partial diffusion.