Gevrey reguarity for a class of dissipative equations with analytic nonlinearity

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Preprint no. 2011-13

Abstract

In this paper, we establish Gevrey class regularity of solutions to a class of dissipative equations on the whole space $\mathbb{R}^d$, for initial data in certain potential spaces. The equation we consider has an analytic nonlinearity and the dissipation operator is a power (possibly fractional) of the Laplacian. This generalizes the results in [15] to the L^p setting, where the space periodic case was considered. Additionally, we allow for rougher initial data and extend the results to the case of the dissipation operator being a fractional Laplacian. The main tool is a generalization of the Kato-Ponce inequality ([28]) to Gevrey spaces. As an application, we obtain temporal decay of solutions in higher Sobolev norms for a large class of equations including the Navier-Stokes equations, the subcritical quasi-geostrophic equations, a variant of the Burger's equation with a polynomial nonlinearity, and the generalized Cahn-Hilliard equation.

2000 AMS Subject Classification: Primary: 76D03, 35Q35, 76D05; Secondary: 35J60, 76F05.

Key words and phrases: Navier-Stokes equations, Quasigeostrophic equations, Dissipative equations, nonlinear analytic equations, Gevrey regularity.

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