Upper bounds on the coarsening rate of discrete, ill-posed, nonlinear diffusion equations

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ABSTRACT

We prove a weak upper bound on the coarsening rate of the discrete-in-space version of an ill-posed, nonlinear diffusion equation. The continuum version of the equation violates parabolicity and lacks a complete well-posedness theory. In particular, numerical simulations indicate sensitive dependence on initial data. Nevertheless, models based on its discrete-in-space version, which we study, are widely used in a number of applications, including population dynamics (chemotactic movement of bacteria), granular flow (formation of shear bands), and computer vision (image denoising and segmentation). Our bounds have implications for all three applications. They are obtained by following a recent technique of Kohn and Otto. Joint work with John Greer.