ERROR ESTIMATES FOR FINITE DIFFERENCE APPROXIMATIONS OF DEGENERATE CONVECTION-DIFFUSION EQUATIONS

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Abstract: Nonlinear convection-dominated flow problems arise in a range of applications. As a consequence it has become a very important undertaking to construct robust, accurate, and efficient methods for the numerical approximation of such problems. Over the years a large number of stable (convergent) numerical methods have been developed for linear and nonlinear convection-diffusion equations in which the "diffusion part" is small, or even vanishing, relative to the "convection part" of the equation. One central, but exceedingly difficult issue relating to such numerical methods, is the derivation of (a priori) error estimates that are robust in the singular limit as the diffusion coefficient vanishes, avoiding the exponential growth of error constants. In this talk, error estimates for a class of simple finite difference approximations for nonlinear and strongly degenerate convection-diffusion problems of the form

$$\begin{cases} \partial_t u + \nabla \cdot f(u) = \Delta A(u), & (t,x) \in (0,\infty) \times \mathbb{R}^d, \\ u(0,x) = u_0(x), & x \in \mathbb{R}^d, \end{cases}$$

where f and A are locally C^1 and $A' \geq 0$ are presented.

References

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