Talk announcement

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FEM discretization and a-priori error estimates for power-law diffusion problems

We start by considering power-law diffusion problems of the form

$$-\operatorname{div}(\mathbf{A}(\nabla u)) = f,$$

where

$$\mathbf{A}(\nabla u) := (k + |\nabla u|)^{p-2}\,\nabla u \ \text{ for some } 1 < p < \infty \ \text{ and some } k \geq 0.$$

We recall the ideas in [1] by introducing a so-called quasi-norm and the respective near-best approximation result. From here, it is not hard to derive as a byproduct a near-best approximation result in the natural $W^{1,p}$ norm which coincides with the error bounds derived in [2, 3]:

$$|u - u_h|_{W^{1,p}(\Omega)} \lesssim \inf_{v_h \in V_h} |u - v_h|^{\frac{p}{2}}_{W^{1,p}(\Omega)} \ \text{ for } 1 < p < 2,$$

$$|u - u_h|_{W^{1,p}(\Omega)} \lesssim \inf_{v_h \in V_h} |u - v_h|^{\frac{2}{p}}_{W^{1,p}(\Omega)} \ \text{ for } p > 2.$$

We extend the ideas from the elliptic case to the corresponding parabolic problem in the context of a space-time finite element discretization and present some numerical results.

Literatur

[1] Diening, L. and Růžička, M. Interpolation operators in Orlicz-Sobolev spaces. *Numer. Math.*, 107(1): 107–129, 2007.

[2] Chow, S.-S. Finite element error estimates for nonlinear elliptic equations of monotone type. *Numer. Math.*, 54(4): 373–393, 1989.

[3] Tyukhtin, V. B. The rate of convergence of approximation methods for solving one-sided variational problems. I. *Teoret. Mat. Fiz.*, 51(2): 111–113, 1982.