Semilinear problems with poly-Laplace type operators

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We deal with semilinear operator equations of the form

$$A^p u = h + F\left(u, Au,\ ...,\ A^{p-1}u\right),$$

where $A^p = AA^{p-1}$ is the p-th iterate of a strongly monotone symmetric linear operator A. The whole approach is based on the theory of the energetic space X_A associated to A. Using fixed point techniques, several existence results are obtained for the problem

$$\begin{cases} A^p u = h + F\left(u, Au,\ ...,\ A^{p-1}u\right) \\ u,\ Au,\ ...,\ A^{p-1}u \in X_A. \end{cases}$$

Here h is a given element of the dual space of X_A and F is on the position of a perturbation of h. In particular, for $A = -\Delta$, we obtain results for semilinear poly-Laplace equations. The presentation is based on the recent work [2] which aimed to bring back to attention and develop in a modern way a classic research theme (see e.g. [1]).

References

[1] Miron Nicolescu, *Les fonctions polyharmoniques*, Actualité Sci. 331, Paris, Herman, 1936.

[2] Radu Precup, *Semilinear problems with poly-Laplace type operators*, Proc. Rom. Acad. Ser. A Math. Phys. Tech. Sci. Inf. Sci., 2022.