Semilinear problems with poly-Laplace type operators

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We deal with semilinear operator equations of the form

\[ A^p u = h + F \left( u, Au, \ldots, A^{p-1}u \right), \]

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

\[
\begin{align*}
A^p u &= h + F \left( u, Au, \ldots, A^{p-1}u \right) \\
u, \ Au, \ldots, \ A^{p-1}u &\in X_A.
\end{align*}
\]

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
