

# Operator-based iterative methods for nonlinear elliptic PDEs

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Nonlinear elliptic problems arise in various physical and other applications where the model describes a stationary state of the given process, such as flow problems, elasticity or glaciology etc. The widespread way to solve such problems is a finite element discretization plus some Newton-like iteration. The talk summarizes earlier and recent work on an operator approach, where quasi-Newton methods are constructed via spectral equivalence, also interpreted as variable preconditioning. The considered problem classes depend on the structural conditions of the nonlinearity. The robustness of the method is illustrated by numerical tests for some real-life models.

## References

- [1] I. Faragó, J. Karátson, *Numerical Solution of Nonlinear Elliptic Problems via Preconditioning Operators: Theory and Applications*, NOVA Science Publishers, 2002.
- [2] B. Borsos, J. Karátson, Quasi-Newton variable preconditioning for nonlinear nonuniformly monotone elliptic problems posed in Banach spaces, *IMA J. Numer. Anal.* (2021), <https://doi.org/10.1093/imanum/drab024>