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INVITATION TO THE LECTURE

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QUASI-NEWTON 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. 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, relying on the structural conditions of the nonlinearity. The general construction and convergence results are illustrated with various applications, such as electromagnetic potentials, elasto-plastic torsion in 2D, subsonic flow, electro-rheology, minimal surfaces, glaciologic flow, Gao beam model, deformation of plates, convection-diffusion systems. Recent joint work with S. Sysala and M. Béreš is summarized on nonlinear elasticity and elasto-plasticity in 3D, where both smooth and nonsmooth problems are considered. Numerical tests illustrate the robustness of the method and its competitiveness with the full Newton linearization.

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