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Smoothing methods and semismooth methods for nondifferentiable operator equations.

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This paper deals with the numerical solution of nonlinear equations in Banach spaces with operators that are not differentiable. Using a concept of semismoothness in infinite-dimensional spaces, which is based upon the notion of slanting functions and slant differentiability and which coincides with the semismoothness in the case of a locally Lipschitz continuous function on $\mathbb{R}^n$, analogues of Newton's method and their superlinear convergence are studied. It is proved that a function is slantly differentiable at some point iff it is Lipschitz continuous.

Finally, the two-dimensional Poisson equation with homogeneous Dirichlet boundary and nonlinear, nonsmooth right-hand side depending on the solution serves as an example.

Reviewer: Etienne Emmrich (Berlin)

MSC:

65J15	Numerical solutions to equations with nonlinear operators
47J25	Iterative procedures involving nonlinear operators
35J65	Nonlinear boundary value problems for linear elliptic equations
65N06	Finite difference methods for boundary value problems involving PDEs
65H10	Numerical computation of solutions to systems of equations

Keywords:

smoothing methods; semismooth methods; superlinear convergence; nondifferentiable operator equation; nonsmooth elliptic partial differential equations; nonlinear operator equation; nonlinear Poisson equation; numerical example; Banach spaces; slanting functions; slant differentiability; Newton's method

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