From linear to nonlinear iterative methods

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Abstract

An investigation on the generalization of the most common classical iterative methods used for the solution of linear systems (like Gauss-Seidel, SOR, Jacobi, and others) to the solution of systems of nonlinear algebraic and/or transcendental equations, as well as to unconstrained optimization of objective functions is conducted. Although the nonlinear iterative rootfinding methods have been extensively studied, the unconstrained optimization case has not been thoroughly analyzed. Thus, in this work unconstrained optimization algorithms for objective functions based on generalizations of iterative linear methods are proposed. Theoretical convergence results for the proposed algorithms are derived for computing a local minimizer of a function. A strategy for developing globally convergent modifications of these algorithms is also conducted. The proposed algorithms have been implemented and tested on classical test problems and on real-life artificial neural network applications and the results to date appear to be very promising. Furthermore preliminary results indicate that utilizing Parallel Virtual Machine (PVM) the speed up achieved is analogous to the number of the processors used, thus considerably shorten the minimization process time.

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