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Multi-step preconditioned Newton methods for solving systems of nonlinear equations.

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Summary: The study of different forms of preconditioners for solving a system of nonlinear equations, by using Newton's method, is presented. The preconditioners provide numerical stability and rapid convergence with reasonable computation cost, whenever chosen accurately. Different families of iterative methods can be constructed by using a different kind of preconditioners. The multi-step iterative method consists of a base method and multi-step part. The convergence order of base method is quadratic and each multi-step add an additive factor of one in the previously achieved convergence order. Hence the convergence of order of an m -step iterative method is $m + 1$. Numerical simulations confirm the claimed convergence order by calculating the computational order of convergence. Finally, the numerical results clearly show the benefit of preconditioning for solving system of nonlinear equations.

MSC:

65H10 Numerical computation of solutions to systems of equations

Keywords:

systems of nonlinear equations; nonlinear preconditioners; multi-step iterative methods; frozen Jacobian

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