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Improving the domain of parameters for Newton's method with applications☆

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Abstract

We present a new technique to improve the convergence domain for Newton's method both in the semilocal and local case. It turns out that with the new technique the sufficient convergence conditions for Newton's method are weaker, the error bounds are tighter and the information on the location of the solution is at least as precise as in earlier studies. Numerical examples are given showing that our results apply to solve nonlinear equations in cases where the old results cannot apply.

Keywords: Banach space, majorizing sequence, local/semilocal convergence, domain of parameters.

1. Introduction

In this study we are concerned with the problem of approximating a locally unique solution x^* of equation

$$F(x) = 0, \tag{1.1}$$

where F is a Fréchet-differentiable operator defined on a convex subset D of a Banach space X with values in a Banach space Y.

Many problems in Applied Sciences including engineering can be solved by means of finding the solutions of equations in a form like (1.1) using Mathematical Modelling [2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 14, 16]. For example, dynamic

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