ON INEXACT NEWTON METHODS FOR SOLVING TWO NONLINEAR MATRIX EQUATIONS[*]

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Abstract

In this paper we consider inexact Newton methods for finding the largest positive definite solutions of two nonlinear matrix equations $X + A^*X^{-1}A = Q$ and $X - A^*X^{-1}A = Q$, respectively. Using Newton's method for considered equations requires solving a Stein's equation at each iteration. For solving the Stein's equation, we use Smith-type iterations instead of exact methods. Nonlocal convergence of the process is shown. Numerical experiments are included to illustrate the theory.

1 Introduction

We consider iterative methods for solving the nonlinear matrix equations

$$X + A^*X^{-1}A = Q \tag{1}$$