

ON INEXACT NEWTON METHODS FOR SOLVING TWO NONLINEAR MATRIX EQUATIONS*

Karolina Nikolova[†] Vejdi I. Hasanov[‡]

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.

Keywords: nonlinear matrix equation, positive definite solution, inexact Newton method.

MSC: 65F10, 15A24.

DOI <https://doi.org/10.56082/annalsarscimag.2024.2.311>

1 Introduction

We consider iterative methods for solving the nonlinear matrix equations

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

*Accepted for publication on September 5, 2024

[†]karolinanikolova@abv.bg Konstantin Preslavsky University of Shumen, Faculty of Mathematics and Informatics, Shumen, Bulgaria

[‡]v.hasanov@shu.bg Konstantin Preslavsky University of Shumen, Faculty of Mathematics and Informatics, Shumen, Bulgaria