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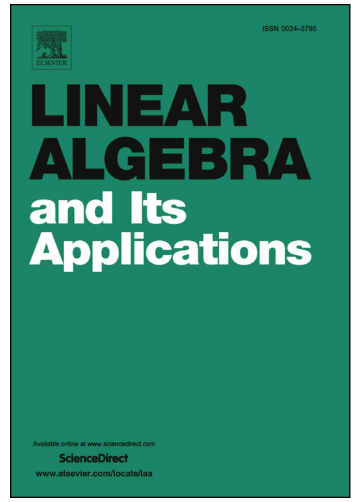

Acute Perturbation of the Group Inverse

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Acute Perturbation of the Group Inverse

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Abstract

For any $n \times n$ complex matrix A, let A_g be the group inverse of A. When A is singular, a matrix $B = A + E$ is said to be an *acute* perturbation of A, if $\|E\|$ is small and the spectral radius $\rho(B_g B - A_g A) < 1$. The *acute* perturbation coincides with the *stable* perturbation of the group inverse, if the matrix B satisfies condition:

$$\mathcal{R}(B) \cap \mathcal{N}(A) = \{0\}, \quad \mathcal{N}(B) \cap \mathcal{R}(A) = \{0\}$$

which introduced by Castro-González, Robles and Vélez-Cerrada (Characterizations of a class of matrices and perturbation of the Drazin inverse, SIAM. J. Matrix Anal. Appl., 30 (2008), pp. 882–897). Furthermore, several examples are provided to illustrate the acute perturbation of the group inverse.

Keywords: Group inverse, acute perturbation, upper bound, spectral radius, oblique projection

AMS Subject Classifications: 15A09, 65F20

1 Introduction and preliminaries

The group inverse [27] has been extensively investigated and widely applied. For instance, it is applied to the solution of singular linear systems [4, 7, 17, 43, 48, 55]. Meyer, singly and with his coauthors established the usefulness of the group inverse in the study and computations of various aspects of Markov chains [1, 19, 22, 24, 25, 30, 29, 34, 35, 37, 38, 39, 46, 47], and to numerical analysis [5, 18, 21, 28, 40, 59, 62, 66]. Recently many papers, e.g., [8, 9, 10, 16, 31, 42, 51, 54, 61, 56, 57, 64], have focused on finding explicit formulae for the Drazin inverse, providing the associated norm upper bounds derived from these various formulae, and making the corresponding error estimations. For the oblique projectors, one can find many results in [3, 20, 36, 45, 49].

For any integers m and n, $\mathbb{C}^{m\times n}$ is the set of $m \times n$ complex matrices. When $m = n$, the identity matrix of order n and the null matrix in $\mathbb{C}^{n\times n}$ are denoted simply by I_n and O,

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