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A DC Algorithm for Solving non-Uniquely Solvable Absolute Value Equations

N. Anane *, Z. Kebaili and M. Achache

Fundamental and Numerical Mathematics Laboratory, Ferhat Abbas University, Setif 1, Setif 19000, Algeria.

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Abstract: In this paper, we deal with the solution of non-uniquely solvable absolute value equations (AVE) of the form $Ax - B|x| = b$, where A, $B \in \mathbb{R}^{n\times n}$ and $b \in \mathbb{R}^n$. To do so, a non-convex quadratic optimization is considered, where its first-order optimality conditions are reduced to AVEs. Therefore, solving the AVE is equivalent to computing the local minimum of the non-convex quadratic optimization. Next, by exploiting the technique of DC programming, a reformulation of the latter as a DC program is presented. The resulting DC algorithm (DCA) is simple and consists of solving a successive linear system of equations. Numerical experiments on some non-uniquely solvable AVE problems are given to illustrate the efficiency of this approach.

Keywords: *absolute value equations; DC programming; linear system; nonlinear modes; nonlinear systems in control theory.*

Mathematics Subject Classification (2010): 90C50, 90C33, 14C20, 70K75, 93C10.

1 Introduction

In this paper, we consider the absolute value equation (AVE) of the form

$$Ax - B|x| = b, \tag{1}$$

where A, $B \in \mathbb{R}^{n\times n}$, $b, x \in \mathbb{R}^n$ and $|x|$ denotes the component-wise absolute value of the vector x. When $B = I$, the AVE (1) reduces to a special form

$$Ax - |x| = b. \tag{2}$$

* Corresponding author: mailto:nasimaannan@gmail.com.