Sociedad de Estadística e Investigación Operativa
Top (2002) Vol. 10, No. 1, pp. 125–145

On the Solution of NP-hard Linear Complementarity Problems

Joaquim J. Júdice*
Departamento de Matemática, Universidade de Coimbra, Coimbra, Portugal
e-mail: judice@dragao.it.uc.pt
Ana M. Faustino and Isabel Martins Ribeiro**
Faculdade de Engenharia, Universidade do Porto. Porto, Portugal
e-mail: afausti@fe.up.pt iribeiro@fe.up.pt

Abstract

In this paper two enumerative algorithms for the Linear Complementarity Problems (LCP) are discussed. These procedures exploit the equivalence of the LCP into a nonconvex quadratic and a bilinear programs. It is shown that these algorithms are efficient for processing NP-hard $LCPs$ associated with reformulations of the Knapsack problem and should be recommended to solve difficult $LCPs$.

Key Words: mathematical programming, complementarity, global optimization, enumerative algorithms.

AMS subject classification: 90C33, 65K10.

1 Introduction

The Linear Complementarity Problem (LCP) consists of finding vectors $z \in \mathbb{R}^n$ and $w \in \mathbb{R}^n$ such that

$$\begin{aligned} & w = q + Mz \\ & z \geq 0, \quad w \geq 0 \\ & z^T w = 0 \end{aligned}$$

for a given matrix $M \in \mathbb{R}^{n \times n}$ and a vector $q \in \mathbb{R}^n$. This problem has originally appeared in the sixties for the solution of bimatrix games and convex quadratic programs. Since then, it has received an increasing interest,

* Support for this author was provided by Instituto de Telecomunicações and by FCT under grant POCTI/35059/MAT/2000

** Support for this author was provided by $PRODEP$ under grant 4/5.3/PRODEP/00

Manuscript received: September 2001. Final version accepted: June 2002.