Accepted Manuscript

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PII: S0167-6377(17)30394-2
DOI: https://doi.org/10.1016/j.orl.2018.02.004
Reference: OPERES 6340

To appear in: *Operations Research Letters*

Received date : 14 July 2017
Revised date : 18 February 2018
Accepted date : 18 February 2018

Please cite this article as: M. Bouafia, D. Benterki, A. Yassine, A new efficient short-step projective interior point method for linear programming, *Operations Research Letters* (2018), https://doi.org/10.1016/j.orl.2018.02.004

A new efficient short-step projective interior point method for linear programming

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Abstract

In this paper, we are interested in the performance of Karmarkar's projective algorithm for linear programming. We propose a new displacement step to accelerate and improve the convergence of this algorithm. This purpose is confirmed by numerical experimentations showing the efficiency and the robustness of the obtained algorithm over Schrijver's one for small problem dimensions.

Keywords: Linear programming, Interior point method, Potential function
2010 MSC: 90C05, 90C31, 90C51

1. Introduction

In his iterative interior point algorithm, Karmarkar showed for a displacement step $\alpha_K = \frac{1}{4}$, the value of the potential function decreases at each iteration by about 0.245 and the algorithm converges after $O(nq + n\ln n)$ iterations [1, 2], where n is the size of the unknown vector of the linear programming problem and q is a fixed precision. Padberg was able to improve the convergence of the classical Karmarkar's algorithm by changing the potential function and showed that for $\alpha_P = \frac{1}{2}$, the algorithm converges after $O(nq)$ iterations [4]. For its part, Schrijver [6], keeping the same Karmarkar's potential function was able to show that the algorithm converges after $\frac{n}{1-\ln(2)} \ln\left(\frac{c^t e_n}{\varepsilon}\right)$ iterations for $\alpha_S = \frac{1}{1+nr}$, where $r = \frac{1}{\sqrt{n(n-1)}}$ such that the value of potential function at each iteration decreases by about 0.30685 [5, 6].

Our work falls within this framework, to improve the results of the work of Karmarkar [1], Padberg [4] and Schrijver [6]. We propose a new displacement

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