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Theoretical and Numerical Results for Nonlinear Optimization Problems

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Abstract: In this work, we develop a new approach for solving a large class of programming optimization problems by employing a logarithmic barrier interior point method, leveraging a vector $\rho \in \mathbb{R}^n_+$ as the penalty term based on some new minorant function. Firstly, we compute the direction by Newton's method. Then, we propose a new alternative way to determine the step length along the direction, our proposed strategy enables easy and quick computation of the step length. Finally, we illustrate the out-performance of our new minorant functions with respect to the line search one through a numerical experiment on numerous collections of test problems.

Keywords: *nonlinear optimization; logarithmic barrier method; applications; minorant function; secant technique; step length.*

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1 Introduction

We consider the nonlinear constrained optimization problem

$$\{\min f(x) : \quad x \in \mathcal{L}\}, \tag{1}$$

where f is a convex and twice continuously differentiable function on $\mathcal{L}$ and $\mathcal{L} = \{x \in \mathbb{R}^n : x \geq 0, Ax = c\}$, with $c \in \mathbb{R}^m$ and $A \in \mathbb{R}^{m\times n}$ being a matrix.
Nonlinear optimization is crucial in various fields such as engineering, economics, machine learning, and nonlinear dynamics and systems (see [3, 8]) for finding optimal solutions under complex constraints.

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