



# Study of a Penalty Method for Nonlinear Optimization Based on a New Approximate Function

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**Abstract:** The aim of this paper is to present a logarithmic penalty method for solving nonlinear optimization. The line search is carried out by means of an approximate function if the descent direction is determined using a classical Newton technique. Contrary to the line search method, which is costly in terms of computing volume and demands a lot of time, the proposed approximate function enables easy and quick computation of the displacement step. Numerous intriguing numerical experiments, which are presented in the last section of this work, show that our new approximate function is accurate and efficient.

**Keywords:** *interior point methods; logarithmic penalty method; applications; approximate functions; nonlinear optimization; quadratic optimization.*

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## 1 Introduction

Nonlinear optimization problems deal with the problem of optimizing an objective function in the presence of equality and inequality constraints. Furthermore, if all the functions are linear, we obviously have a linear optimization problem. Otherwise, the problem is called a nonlinear optimization problem.

This research field is motivated by the fact that several problems are collected from practice such as engineering, medicine, business administration, economics, physical sciences, and nonlinear dynamics and systems (see, e.g., [8, 9]).

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