

Optimality of Mathematical Programming Problems with Rough Convexity of Objective Function

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Abstract

The concept of convexity of sets and functions plays an important role in the field of mathematical programming. Convexity ensures the globality of solutions. In real life problems, the convexity might not be satisfied. So in this study, an optimality of a nonlinear programming problem in which the objective function is rough convex with respect to a family of convex functions is discussed. The sufficient and the necessary Kuhn Tucker conditions of optimality for these kind of problems is presented. An illustrative example are presented to clarify the results. Finally the results of this study will be used in many field such as: mathematical programming, engineering, and other sciences.

Keywords

Rough Convexity, Rough Nonlinear Programming Problem, Kuhn Tucker Saddle Point, Kuhn Tucker Conditions

1. Introduction

The concept of convexity has been discussed intensively before. In this study, the researchers discuss the concept of rough convexity in a different way, by discussing objective function with respect to a family of convex functions. This study aims to find a solution to a nonlinear problem where the objective function is nonconvex, by discussing it with respect to a family of convex functions. This study will be applied to the fields of mathematical programming and generalized parametric programming problems.

In literature, the concept of optimality of mathematical programming with generalized convexity had been discussed early in [2], and [7].

The class of convex functions has been extended to the class of B-convex functions by [3] and to class of invex functions by [5] and [6]. In [10], Youness introduced the concept of E-convex which is more generalized convexity. Also Yang in [9] introduced a technical note on E-convex sets, E-convex functions, and E-convex programming.

Sih-Yu Wu in [8] introduced the concept of semistrictly

convex fuzzy sets that lies between convex fuzzy sets and strictly convex fuzzy sets, and Ammar in [1] presented the optimality fuzzy linear and nonlinear programming with generalized convexity.

Emam and Youness in [13] and [14] introduced a new class of E-convex sets and E-convex functions which is called semi strongly E-convex sets and strongly E-convex functions by taking the images of two points, x and y , under an operator $E: R^n \rightarrow R^n$ besides the two points themselves and strongly E-convex sets and strongly E-convex functions.

The rough notion is more important in the field of optimization problems in which some data are vague. Rough convexity is considered as describe the convexity of sets or functions via family of convex sets or convex functions.

In [4], Deng presented an approximation of convexity for non convex sets by using the concept of directional convexity of a set which is used to define the upper and lower convexity of a non convex set. In [11], Youness presented a formulation of a rough programming problem in which the decision set is rough, and discussed the rough optimality solution for these kind of problems.

Youness and Alsaraireh in [12], introduced a new approximation to convexity of a set and a function. This

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Modern Nonconvex Nondifferentiable Optimization Ying Cui, Jong-Shi Pang, 2021-12-02 Starting with the fundamentals of classical smooth optimization and building on established convex programming techniques this research monograph presents a foundation and methodology for modern nonconvex nondifferentiable optimization It provides readers with theory methods and applications of nonconvex and nondifferentiable optimization in statistical estimation operations research machine learning and decision making A comprehensive and rigorous treatment of this emergent mathematical topic is urgently needed in today s complex world of big data and machine learning This book takes a thorough approach to the subject and includes examples and exercises to enrich the main themes making it suitable for classroom instruction *Modern Nonconvex Nondifferentiable Optimization* is intended for applied and computational mathematicians optimizers operations researchers statisticians computer scientists engineers economists and machine learners It could be used in advanced courses on optimization operations research and nonconvex and nonsmooth optimization *Approximation, Optimization and Mathematical Economics* Marc Lassonde, 2012-12-06 The articles in this proceedings volume reflect the current trends in the theory of approximation optimization and mathematical economics and include numerous applications The book will be of interest to researchers and graduate students involved in functional analysis approximation theory mathematical programming and optimization game theory mathematical finance and economics [Optimality and Stability in Mathematical Programming](#) M. Guignard, Mathematical Programming Society, 1982 *Subject Guide to Books in Print*, 1993

Perturbation Analysis of Optimization Problems J. Frederic Bonnans, Alexander Shapiro, 2013-11-22 The main subject of this book is perturbation analysis of continuous optimization problems In the last two decades considerable progress has been made in that area and it seems that it is time now to present a synthetic view of many important results that apply to various classes of problems The model problem that is considered throughout the book is of the form $P \text{ Min } x \text{ subject to } G x \in E, K \text{ x} \in X$ Here X and Y are Banach spaces K is a closed convex subset of Y and $X \in \mathbb{R}$ and $G: X \rightarrow Y$ are called the objective function and the constraint mapping respectively We also consider a parameterized version P of the above u problem where the objective function $x \rightarrow u$ and the constraint mapping $G: x \rightarrow u$ are parameterized by a vector u varying in a Banach space U Our aim is to study continuity and differentiability properties of the optimal value $v(u)$ and the set $S(u)$ of optimal solutions of P viewed as functions of the parameter vector u

Multiobjective Problems of Mathematical Programming Andrzej Lewandowski, 1991 This book presents recent developments in methodology theory software and implementation of Decision Support Systems It deals with the theory and algorithms for multiple criteria optimization and discusses topics like multiple criteria optimization in hierarchical systems relations between simulation and gaming for conflict resolution and sensitivity and trade off analysis in multiobjective programming In addition it treats applications and computer implementations of Decision Support Systems This includes experience in applying Decision Support Systems for industry management bank

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Table of Contents Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19

1. Understanding the eBook Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - The Rise of Digital Reading Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Advantages of eBooks Over Traditional Books
2. Identifying Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Optimality And Stability In Mathematical Programming Mathematical Programming

Study Volume 19

- User-Friendly Interface
- 4. Exploring eBook Recommendations from Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Personalized Recommendations
 - Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 User Reviews and Ratings
 - Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 and Bestseller Lists
- 5. Accessing Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 Free and Paid eBooks
 - Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 Public Domain eBooks
 - Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 eBook Subscription Services
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- 6. Navigating Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 eBook Formats
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 - Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19 Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Highlighting and Note-Taking Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Interactive Elements Optimality And Stability In Mathematical Programming Mathematical Programming Study

Volume 19

8. Staying Engaged with Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
9. Balancing eBooks and Physical Books Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Setting Reading Goals Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Fact-Checking eBook Content of Optimality And Stability In Mathematical Programming Mathematical Programming Study Volume 19
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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