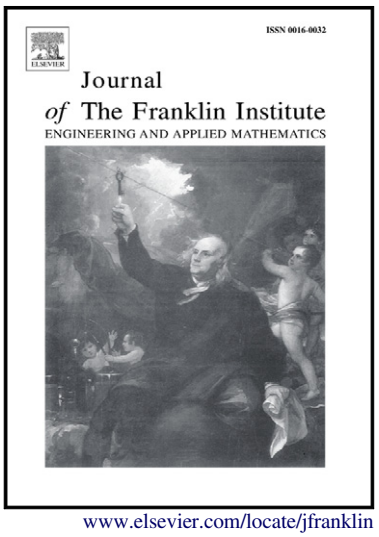

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A hybrid approximation scheme for discretizing constrained quadratic optimal control problems

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Abstract

In this paper, a composite Chebyshev finite difference method for solving linear quadratic optimal control problems with inequality constraints on state and control variables is introduced. This method is an extension of Chebyshev finite difference scheme and is based on a hybrid of block-pulse functions and Chebyshev polynomials using the well known Chebyshev-Gauss-Lobatto nodes. The excellent properties of hybrid functions are used to convert optimal control problem into a mathematical programming problem whose solution is much more easier than the original one. Various types of optimal control problems are investigated to demonstrate the effectiveness of the proposed approximation scheme. The method is simple, easy to implement and provides very accurate results.

AMS Subject Classifications: 49J15; 65K15; 34K28; 93C10.

KEY WORDS: optimal control; inequality constraints; hybrid functions; Chebyshev-Gauss-Lobatto nodes; composite Chebyshev finite difference.

1. Introduction

Numerical methods for solving linear and nonlinear optimal control problems are typically described under two categories: direct methods and indirect methods [1- 4]. Historically, many early numerical methods were based on finding solutions to satisfy a set of necessary optimality conditions resulting from Pontryagin's Maximum Principle [4 -7]. These methods are collectively called indirect methods. There are many successful implementations of indirect methods

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