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STATE-CONTROL PARAMETERIZATION FOR SOLVING LINEAR CONSTRAINED OPTIMAL CONTROL PROBLEMS BY USING CHEBYSHEV WAVELETS

Z. Rafiei[1] and B. Kafash[2] and S.M. Karbassi[1]

[1]Faculty of Mathematics
Yazd University P.O. Box: 89197/741 Yazd, Iran

[2]Faculty of Engineering
Ardakan University, Ardakan, Iran

Abstract. This paper introduces a numerical method for solving the linear constrained optimal control problems with quadratic performance index. This method is based on using state-control parameterization technique to approximate the state and control variables by a finite length Chebyshev wavelet series of unknown parameters. An important property of this method is that there is no need to compute the operational matrix of derivative or integration matrix of Chebyshev wavelet for converting the constrained quadratic optimal control problem to an optimization problem. The validity and applicability of this technique are showed by presenting some illustrative examples.

Keywords. Constrained optimal control; State-control parameterization; Chebyshev wavelet; Linear-quadratic; Breakwell problem

AMS (MOS) subject classification: 49M30. 49M37. 49N10

1 Introduction

Two major classes of numerical methods are used for solving optimal control problems. Indirect methods and direct methods. Indirect method is based on converting the optimal control problem into a two-point boundary value problem. Although, this method have some advantages such as existence and uniqueness of obtained solutions, but in practice the most of control problems are described by strongly nonlinear differential equations and hard to be solved by indirect methods. Thus, many researchers were proposed direct methods to solve optimal control problems which are based on converting optimal control problems into an optimization problem and apply existing optimization techniques to solve them. On the other hand, the presence of inequality constraints often results in both analytical and computational difficulties. So, many computational methods in order to handle