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APPROXIMATE OPTIMAL OUTPUT TRACKING CONTROL FOR A CLASS OF LINEAR DISCRETE-TIME SYSTEMS WITH TIME-DELAY

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Abstract. This paper is concerned with the optimal output tracking control (OOTC) for a class of discrete-time systems with time-delay. By introducing a sensitivity parameter, the original OOTC problem is transformed into a series of two-point boundary value (TPBV) problems without delay or advance terms. The OOTC law obtained consists of linear analytic functions and a compensation term which is a series sum of adjoint vectors. The linear analytic functions can be found by solving a *Riccati* matrix equation and a *Sylvester* equation respectively. The compensation term can be approximately obtained by a recursion formula of adjoint vector equations. A reference input observer is constructed such that the approximate OOTC law is physically realizable. A numerical example is given to show the effectiveness of the presented algorithm.

Keywords. Discrete-time systems, Time-delay, Optimal control, Tracking control, Sensitivity approach.

AMS (MOS) subject classification: 49N35.

1 Introduction

Time-delay is quite common in practical control systems. The problems of stability and control of time-delay systems have attracted much attention. For example, Han [5] investigated the stability for a class of uncertain linear neutral systems and derived some delay-dependent stability criteria. The result in Han [5] was improved by using the discretized Lyapunov functional method in Han et al. [6]. Yue and Han [13] designed a delayed feedback control law for uncertain linear systems with time-varying input delay. Cai et al. [1] used a non-delay conversion to present an optimal control method for linear time-delay systems in vibration control; Chu [3] applied a discrete-time optimal tracking controller to an industrial electric heater with multiple state delays; Kolmanovsky and Maizenberg [8] studied a finite-time horizon optimal control problem for randomly varying time-delay systems. The optimal control problems for time-delay systems with quadratic performance index generally lead to a TPBV problem with both delay and advance terms,