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Observer Based Output Tracking Control for Bounded Linear Time Variant Systems

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Abstract: In this paper, we propose a new approach to design a reduced observer based state feedback control for bounded linear time variant systems by means of shifted *Legendre* polynomials. The main objective is to force the controlled *LTV* system output to follow that of a linear reference model. On these grounds, augmented state modeling and useful Kronecker product properties are applied. Hence, an optimization problem is derived. Once the observation and control gains are determined by solving the latter problem, the stability of the closed loop system is checked through LMIs conditions. Simulation results illustrate the pertinence of the proposed method.

Keywords: *LTV systems; state observer; tracking; shifted Legendre polynomials, LMIs.*

Mathematics Subject Classification (2010): 93B50, 93C05.

1 Introduction

Modeling a physical process is a crucial step toward its analysis and adapted control synthesis. Indeed, the chosen mathematical model should be accurate enough in order to describe correctly dynamics of the system evolution. Moreover, most physical systems are described by nonlinear models which are not easy to study. A simplification alternative consists in linearizing the systems around some operating points, the procedure remains a very conservative approach. A global method consists in a linearization along a trajectory, that often leads to a linear time varying system (LTV) [2]. Thus, this type of models offer a good compromise between simplicity and ability to reproduce with fidelity the behavior of some real processes namely, highway vehicle [1], electronic circuit design [3] and biochemical systems [8]. Accordingly, several studies have focused on poles and zeros definition for these particular systems [4], also problems related to the controllability

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