STATIC SWITCHED OUTPUT FEEDBACK STABILIZATION FOR LINEAR DISCRETE-TIME SWITCHED SYSTEMS

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Abstract. This paper focuses on the problem of switched static output feedback (SOF) control for discrete-time switched linear systems under arbitrary switching laws. The considered class of systems is characterized by a particular structure of system matrices. Our principle idea is addressed in the derivation of new sufficient linear matrix inequalities conditions for the synthesis of a switched controller for a particular class of switched systems. The adopted methodology is based on the using of a special congruence transformation and a switched quadratic Lyapunov function. We propose important sufficient LMI conditions for SOF stabilization in the general case which guarantee the switched-quadratically stability of the closed-loop system. The various conditions are given through a family of LMI (linear matrix inequalities) parameterized by a scalar variable which offers an additional degree of freedom, enabling, at the expense of a relatively small degree of complexity in the numerical treatment (one line search), to provide better results compared with previous ones in the literature. A numerical example is presented to illustrate the effectiveness of the proposed conditions.

Keywords: Switched system, Static output feedback, LMI

1. Introduction. Switched linear systems are an important class of Hybrid Dynamical Systems (HDS) [1, 3, 16]. A switched system is represented by a set of continuous-time or discrete-time subsystems and a rule that orchestrates the switching among them. In this area, the suitable control problem is directed towards the determination of an adaptive switched control assuming the real time knowledge (possibly by identification) of the switching process. Switched systems have numerous applications in control of mechanical systems, the automotive industry, aircraft and air traffic control, switching power converters, and many other fields which include the modelling of communication networks, networked control systems, the modelling of bio-chemical reactions, the control of systems with large uncertainty using logic-based supervisors, etc. In recent years, an increasing interest in the study of stability analysis and control design for switched systems [4, 7, 26, 27] can be noticed. The stability and control synthesis issues for discrete switched systems under arbitrary switching sequences are addressed [28, 29]. In practice, switched systems can be applied to various modelling and control problems present in robotics, automotive systems, process control, power systems, air traffic control, switching power converters, and many other fields which include the modelling of communication networks, networked control systems, the modelling of bio-chemical reactions, the control of nonlinear systems that cannot be stabilized by continuous control laws, the control of systems with large uncertainty using logic-based supervisors, etc. [16, 17]. In recent years, particular efforts of researches have received an increasing interest and a growing attention in the study of the stability analysis and control design for switched systems [4, 7, 21, 22, 23].