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A Separation Principle of a Class of Time-Varying Dynamical Systems

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Abstract: This paper studies the separation principle for a class of nonlinear time-varying dynamical systems whose dynamics are in general bounded in time. The resultant observer-based state feedback control guarantees practical stability of the state oscillation given that the system is both uniformly controllable and observable. Our separation principle relies on stability results for cascades systems.

Keywords: *nonlinear differential equations; stabilization; Lyapunov functions; practical stability; Riccatti equation.*

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1 Introduction

The stability problem of nonlinear time-varying systems has attracted the attention of several authors and has produced many important results [8], [11], [12], [13] and [14] and the references therein. The problem of state trajectory control for nonlinear systems by output feedback has received much attention. For systems with non-periodically time-varying parameters, an output feedback control design is proposed in [4] for linear time-varying systems based on the gradient algorithm. In [5], a new design is proposed for the state feedback control of multivariable linear time-varying systems. The new design is based on inversion state transformation and a forward differential Riccati equation.

The condition that we impose on the globally stabilizing state feedback control law is that it does not vanish asymptotically for large values. Then, we will give a separation principle based on analysis results for cascaded systems, as done for instance in [1] , [2], [3], [6], [7], [9] and [10]. However, in contrast to [11] we stress that our results will be formulated for time-varying systems and hence are applicable to tracking problems. Moreover as mentioned above, in [15] the author imposes the more restrictive assumption ISS. Our cascades criteria lead to milder conditions.

The main contribution of this paper is the separation principle of nonlinear systems by a linear output feedback under a generalized conditions. A practical stability approach is obtained. Furthermore, we give an example to show the applicability of our result

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