控制与决策 2012, 27(2) 304-307 DOI: ISSN: 1001-0920 CN: 21-1124/TP

短文

一类Lipschitz 非线性切换系统基于观测器的 H∞ 输出跟踪控制

李莉莉[1],**邵诚**[2]

1. 大连理工大学 电信学部
2. 大连理工大学先进控制技术研究所

摘要:

针对一类Lipschitz 非线性切换系统, 研究基于观测器的??∞ 输出跟踪控制问题. 借助微分中值定理, 将Lipschitz 非线性切换系统转化为线性参数切换系统. 当状态变量不可测或不易测时, 利用多Lyapunov 函数方法, 同
时设计观测器、基于观测器的跟踪控制器和滞后切换信号, 使得系统满足??∞ 输出跟踪性能. 最后通过仿真例子表
明了设计方法的有效性.

关键词: 切换系统；??&infin 输出跟踪控制；观测器

Observer-based ??∞ output tracking control for a class of switched Lipschitz nonlinear systems

Abstract:

This paper studies with the problem of observer-based H∞ output tracking control for a class of switched
Lipschitz nonlinear systems. The differential mean value theorem allows transforming the switched Lipschitz nonlinear
systems into switched linear parameter-varying systems. By using a multiple Lyapunov functions approach, observers,
observer-based tracking controllers and a hysteresis switching law are designed simultaneously to achieve the H∞ output
tracking control performance, when the states are not completely available for switching and controller design. Finally, a
numerical example shows the effectiveness of the proposed method.

Keywords: switched system；H&infin output tracking control；observer

收稿日期 2010-09-13 **修回日期** 2011-04-04 **网络版发布日期** 2012-02-13

DOI:

基金项目:

国家重点基础研究发展计划(973)项目

通讯作者: 李莉莉

作者简介:

作者Email: tolilili@gmail.com

参考文献:

[1] Liberzon D, Morse A S. Basic problem in stability and design of switched systems [J]. IEEE Control System Magazine, 1999, 19(5): 59-70. [2] Liberzon D. Switching in Systems and Control [M]. Boston: Birkhauser, 2003: 1-166. [3] Sun Z D, Ge S S. Switched Linear Systems Control and Design [M]. London: Springer-Verlag, 2004: 1-228. [4] Hespanha J P, Morse A S. Stability of switched systems with average dwell-time [C]. Proceedings of the 38th IEEE Conference on Decision and Control. Phoenix:

IEEE, 1999: 2655-2660. [5] Li L L, Feng J X, Dimirovski G M, Zhao J. Reliable stabilization and H∞ control for switched systems with faulty actuators: an average dwell time approach [C]. Proceedings of the American Control Conference. St. Louis: IEEE, 2009: 1072-1077. [6] 李莉莉, 赵军. 一类非线性离散切换系统基于观测器的指数镇定 [J]. 控制理论与应用，2009, 26(7): 786-790. [7] Sharma R, Tewari A. Optimal nonlinear tracking of spacecraft attitude maneuvers [J]. IEEE Trans. on Control Systems Technology, 2004, 12(5): 677-682. [8] No T S, Min B M, Stone R H, Wong K C. Control and simulation of arbitrary flight trajectory-tracking [J]. Control Engineering Practice, 2005, 13(5): 601-612. [9] Tomei P. Tracking control of flexible joint robot with uncertain parameters and disturbances [J]. IEEE Trans. Automatic Control, 1994, 39(5): 1067-1072. [10] 阎九喜, 程兆林. 奇异动态经济系统最优跟踪控制问题[J]. 自动化学报, 1998, 24(3): 428-430. [11] Li Q K, Zhao J, Dimirovski G M. Robust tracking control for switched linear systems with time-varying delays [J]. IET Control Theory and Applications, 2008, 2(6): 449-457. [12] Li Q K, Zhao J, Dimirovski G M. Tracking control for switched linear systems with time-delay a state-dependent switching method [J]. Asian Journal of Control, 2009, 11(5): 517-526. [13] Lian J, Zhao J, Liu X J, Dimirovski G M. Model reference adaptive integral sliding mode control for switched delay systems [J]. International Journal of Innovative Computing Information and Control, 2008, 4(8): 2025-2032. [14] Wang M, Zhao J, Dimirovski G M. Variable structure control method to the output tracking control of cascade nonlinear switched systems [J]. IET Control Theory and Applications, 2009, 3(12): 1634-1640. [15] Wang M, Zhao J, Dimirovski G M. Output tracking control of nonlinear switched cascade systems using a variable structure control method [J]. International Journal of Control, 2010, 83(2): 394-403. [16] Li Q K, Zhao J, Dimirovski G M. Robust tracking control for switched linear systems with time-delay: an average dwell time approach [J]. Dynamics of Continuous, Discrete and Impulsive Systems Series B: Applications & Algorithms, 2009, 16(2): 167-180. [17] Li Q K, Zhao J, Liu X J, Dimirovski G M. Observer-based tracking control for switched linear systems with time-varying delay [J]. International Journal of Robust and Nonlinear Control, 2010, online: DOI:10.1002/rnc.1597. [18] Zemouche A, Boutayeb M, Bara G I. Observers for a class of Lipschitz systems with extension to H∞ performance analysis [J]. Systems and Control Letters, 2008, 57(1): 18－27. [19] Zemouche A, Boutayeb M. A unified H∞ adaptive observer synthesis method for a class of systems with both Lipschitz and monotone nonlinearities [J]. Systems and Control Letters, 2009, 58(4): 282－288. [20] Cao Y, Sun Y, Cheng C. Delay dependent robust stabilization of uncertain systems with multiple state delays [J]. IEEE Trans. Automatic Control, 1998, 43(11): 1608-1612.

本刊中的类似文章