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论文

广义双线性系统的二阶终端滑模控制

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摘要:

利用Lyapunov 稳定性理论研究了一类广义双线性系统的镇定问题. 通过构造特殊的二阶终端滑模超曲面, 设计相应的变结构控制器, 使闭环系统在有限时间内实现滑动模运动, 系统的状态在平衡点渐近稳定. 该设计方法能
有效削弱系统的高频抖振. 仿真结果验证了设计方法的可行性.

关键词: 广义双线性系统；终端滑模控制；有限时间收敛；Lyapunov 方法；渐近稳定性

Second-order terminal sliding mode control for singular bilinear systems

Abstract:

Lyapunov stability theory is employed to investigate the stabilization problems in a class of singular bilinear
systems. A special second-order terminal sliding mode hyper-surface is constructed and the corresponding variable structure
controller is designed to make the sliding mode move in finite time and to guarantee the closed-loop systems to be
asymptotically stable. The high frequency chattering of the control signals in the class of singular bilinear systems is reduced
by using the method designed. Simulation results show the feasibility of the designed approach.

Keywords: singular bilinear systems；terminal sliding mode；finitetime convergence；Lyapunov method；asymptotical
stability

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广义系统的终端滑模控制

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参考文献:

参考文献: [1] Dai L Y. Singular control systems. Speinger—Verlag, 1989. [2] 杨冬梅，张庆灵，姚波. 广义系统[M]. 北京: 科学出版社，2004. [3] Zasadzinski M, Magarotto E, Rafaralahy H, et al. Residual generator design for singular bilinear systems subjected to unmeasurable disturbances: an LMI approach [J]. Automatica, 2003, 39: 703-713. [4] Lu G P, Daniel W C H. Continuous stabilization controllers for singular bilinear systems: The state feedback case [J]. Automatica, 2006, 42: 309-314. [5] 张秀华, 张庆灵. 双线性广义系统稳定性控制分析[J]. 控制工程, 2006, 21(2): 192-195. [6] 兰奇逊，梁家荣，高许岗. 不确定广义双线性系统的鲁棒镇定[J]. 自动化学报，2008，34（6）: 707-710. [7] Man Z H, Paplinski A P, Wu H R. A robust MIMO terminal sliding mode control scheme for rigid robotic

manipulators [J]. IEEE Trans.on Automatic Control, 1994, 39(12): 2464-2469. [8] Yu X H, Man Z H. Fast terminal sliding mode control design for nonlinear dynamic systems [J]. IEEE Trans.on Circuits Systems Part I, 2002, 49(2): 261-264. [9] Yu S H, Ma Z, Yang X H. Nonsmooth finite-time control of uncertain second-order nonlinear systems [J]. Journal of Control Theory and Applications, 2007, 5(2): 171-176. [10] Liu J K, Sun F C. A novel dynamic terminal sliding mode control of uncertain nonlinear systems [J]. Journal of Control Theory and Applications, 2007, 5(2): 189-193. [11] Feng Y, Yu X H, Man Z H. Non-singular terminal sliding mode control of rigid manipulators [J]. Automatica, 2002, 38: 2159-2167. [12] Zheng X M, Zhao L, Feng Y, et al. TSM control of the delayed input system [J]. Journal of Harbin Institute of Technology. 2007, 14(6): 788-792. [13] Guo Y S, Chen L. Terminal sliding mode control for coordinated motion of a space rigid manipulator with external disturbance [J]. Applied Mathematics and Mechanics, 2008, 29(5): 583-590. [14] Wang H, Han Z Z, Xie Q Y, et al. Finite-time chaos control via nonsingular termina1 sliding mode control [J]. Commun Nonlinear Sci Numer Simulat, 2009, 14: 2728-2733. [15] 李升波，李克强，王建强，等. 非奇异快速的终端滑模控制方法[J]. 信息与控制，2009，38（1）：1-8. [16] 周丽，姜长生，都延丽. 一种基于反步法的鲁棒自适应终端滑模控制[J]. 控制理论与应用，2009，26（6）:678-682. [17] Bartolini G, Ferrara A, Usai E. Chattering avoidance by second-order sliding mode control [J]. IEEE Trans.on Automatic Control, 1998, 43(2): 241-246.

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