控制与决策 2011, 26(10) 1591-1595 DOI: ISSN: 1001-0920 CN: 21-1124/TP

短文

非线性控制系统状态方程直接积分解法

曹少中[1],涂序彦[2]

1. 北京印刷学院
2. 北京科技大学

摘要：

鉴于非线性系统分析的核心归结为系统状态方程的求解, 针对一般非线性控制系统, 引入由状态量、控制量与自变量时间?? 为坐标构成的“广义时态空间”. 为了求解非线性状态方程, 在广义时态空间(????, ??(??), ??(??)) 处将方程的右端展开为(?? − ????) 的Taylor 级数, 通过直接积分获得了非线性控制系统状态方程关于自变量时间(?? = ?? − ????)的级数解, 并证明了解的收敛性.

关键词： 非线性控制系统；状态方程；直接积分；Taylor 级数

Direct-integrating approach for solving state equation of nonlinear control systems

CAO Shao-zhong1, TU Xu-yan2

Abstract:

The kernel of nonlinear system analysis is the solving of system state equation. Therefore, for a general nonlinear control system, the concept of general time-state space comprising of state variables, control variable, and time ?? is introduced. In order to solve the state equation of nonlinear control systems, at the operation point (????, ??(??), ??(??)) of general time-state space, the right side of the state equation can be expanded as Taylor series about (?? − ????). Then the series solution of the nonlinear control state equation, for which the solution is expression in (?? − ????) series, can be obtained by using direct-integrating approach. Finally, the convergence of the solution is proved.

Keywords: nonlinear control systems；state equation；direct-integrating；Taylor series

收稿日期 2010-07-06 修回日期 2011-01-25 网络版发布日期 2011-09-30

DOI:

基金项目:

北京市自然科学基金

通讯作者: 曹少中

作者简介:

作者Email: cszh6502@163.com

参考文献：

1 Isidori A. Nonlinear Control Systems. New York：Springer-Verlag ,1995 2 Hong Yi-guang，Cheng Dai-zhan. Nonlinear Systems Analysis and Control . Beijing：Science Press，2005 (洪奕光，程代展. 非线性系统的分析与控制. 北京：科学出版社，2005) 3 Douglas A. Lawrence. Input－output pseudolinearization on controlled invariant submanifolds. Automatica, 2005, 41(1): 163-166 4 H. M. Srivastava, A. W. Niukkanen. Some Clebsch-Gordan type linearization relations and associated families of Dirichlet integrals. Mathematical and Computer Modelling, 2003, 37(3-4): 245-250 5 Doyle III F J , Allgower F and Morari M. Normal form approach to approximate input-output linearization for maximum phase nonlinear

SISO systems. IEEE Trans . Automat. Contr., 1996, 41(2):305- 309 6 S. Albeverio, R. Bozhok and V. Koshmanenko. The rigged hilbert spaces approach in singular perturbation theory. Report on Mathematical Physics, 2006, 58(2): 227-246 7 Tzu-Chu Lin , David H. Schultz and Weiqun Zhang. Numerical solutions of linear and nonlinear singular perturbation problems. Computer & Mathematics Applications, 2008, 55(11): 2574-2592 8 Stephen Schecter. Traveling-wave solutions of convection－diffusion systems by center manifold reduction. Nonlinear Analysis, 2002, 49(1): 35 － 59 9 Daizhan Cheng, Yuqian Guo. Stabilization of nonlinear systems via the center manifold approach. Systems & Control Letters, 2008, 57(6): 511－518 10 Anael Verdugo a, Richard Rand. Center manifold analysis of a DDE model of gene expression. Communications in Nonlinear Science and Numerical Simulation, 2008, 13(6): 1112－1120 11 C.F. Samons. Differential Equations. Beijing: People Education Press, 1981. (C.F. 塞蒙斯. 微分方程. 北京:人民教育出版社, 1981)

本刊中的类似文章