

光通信与光信息技术

新型二自由度Smith预估控制在ATP伺服系统中的应用

汪蓉蓉, 方安安, 冯庆

南昌大学 信息工程学院, 南昌 330031

摘要:

为了提高空间光通信的捕获、跟踪与瞄准系统的跟踪精度,提出了一种新型二自由度Smith预估控制的实现方法。首先对捕获、跟踪与瞄准伺服系统和新型二自由度Smith预估控制系统进行结构分析,然后通过讨论传递函数建立仿真模型,利用MATLAB仿真软件进行仿真,并与多种传统的比例-积分-微分(PID)控制系统进行比较。结果表明,新型控制方法不但具有Smith预估器对时滞有效控制的优点,更显现出不完全微分先行PID控制和比例-积分控制的良好匹配效果,能够很好地解决纯时滞造成的不稳定性,而且具有较好的鲁棒性和抗干扰性。

关键词: 光通信 ATP伺服系统 二自由度Smith预估控制 鲁棒性 抗干扰性

Application of novel two degree-of-freedom Smith predictive control in ATP servo systems

WANG Rong-rong, FANG An-an, FENG Qing

College of Information Engineering, Nanchang University, Nanchang 330031, China

Abstract:

In order to improve the tracking accuracy of acquisition, tracking, pointing(ATP) control system for space optical communication, a novel two degree-of-freedom Smith predictive control was presented. Firstly, the ATP servo control system and novel two degree-of-freedom Smith predictive control system were analyzed. Then the simulation model was established by discussing the transfer function. Simulation was carried out with MATLAB software. Finally, the obtained result was compared with that of some conventional proportion-integral-derivative(PID)controllers, and the anti-interference and robustness of the method were measured. The simulation results show that the novel control method not only has the advantage of Smith predictor delay effective control, but also show the good match effect of incomplete derivative forward PID control and proportion-integral(PI) control. This method is a good solution to the instability caused by pure time delay, it also has better robustness and immunity.

Keywords: optical communication ATP servo system two degree-of-freedom Smith predictive control robustness anti-interference

收稿日期 2012-12-31 修回日期 2013-02-28 网络版发布日期 2013-07-25

DOI: 10.7510/jgjs.issn.1001-3806.2013.05.019

基金项目:

通讯作者: 方安安, E-mail: 1583972375@qq.com

作者简介: 汪蓉蓉(1988-),女,硕士研究生,主要研究方向为光通信领域、控制技术。

作者Email: 1583972375@qq.com

参考文献:

- [1] PAN Y Zh, ZHANG J, HU G J, *et al.* Photonic crystal fiber and laser[J]. Laser Technology, 2004, 28(1): 48-51(in Chinese).
- [2] SUN A X, WANG J, HE H X. Testing precision analysis of centrobaric of laser facula[J]. Laser Technology, 2004, 28(6) : 667-672(in Chinese).
- [3] ZUO T, AI Y, HUANG H B, *et al.* Multiple control method of ATP system for space optical communication[J]. Infrared and Laser Engineering, 2011, 40(1): 107-111(in Chinese).
- [4] ZHANG H T, ZHENG L. Simulation of networked control system based on smith compensator and single neuron incomplete differential forward PID [J]. Journal of Networks, 2012, 48(8): 243-245(in Chinese).
- [5] CUENCA A, SALT J, CASANOVA V, *et al.* An approach based on an adaptive multi-rate smith

扩展功能

本文信息

- Supporting info
- PDF(1474KB)
- [HTML全文]
- 参考文献[PDF]
- 参考文献

服务与反馈

- 把本文推荐给朋友
- 加入我的书架
- 加入引用管理器
- 引用本文
- Email Alert
- 文章反馈
- 浏览反馈信息

本文关键词相关文章

- 光通信
- ATP伺服系统
- 二自由度Smith预估控制
- 鲁棒性
- 抗干扰性

本文作者相关文章

- 汪蓉蓉
- 方安安
- 冯庆

PubMed

- Article by Wang,R.R
- Article by Fang,A.A
- Article by Feng,q

- predictor and gain scheduling for a networked control system: implementation over profibus-DP[J]. International Journal of Control, Automation, and Systems, 2010, 8(2): 473-481.
- [6] LIN R Q, YANG F W, QIU G W. Realization of a class of neuron controller based on smith predictor[J]. Information and Control, 2004, 33(2): 137-140(in Chinese).
- [7] AN L X, MA H M, LIU Y G, *et al.* A 2th order time delay system based on improved fuzzy smith predictor[J]. Computer Simulation, 2011, 28(1): 198-233(in Chinese).
- [8] LI M, AI Y, CAO Y. Research of fine tracking servo system for FSO terminal[J]. Laser Technology, 2009,33(3): 262-265(in Chinese).
- [9] KANG K. Realization of digital PID DC motor speed control system based on the MATLAB[J]. Computer Knowledge and Technology, 2010, 6(22): 6372-6374(in Chinese).
- [10] LUO T. Technology of acquisition, tracking in satellite laser communication[D]. Chengdu: University of Electronic Science and Technology of China, 2004: 21-29 (in Chinese).
- [11] FAN W, YU X F, XI L. Research on driving system and controlling means of PZT[J]. Optics and Precision Engineering, 2007, 6(22): 368-371 (in Chinese).
- [12] HU L W, WANG Q Z, TENG D. Analysis for control methods based on time-delay object[J]. Control and Instruments in Chemical Industry,2010,37(5):23-25(in Chinese).

本刊中的类似文章

1. 易淼 陈名松 李天松 孙丽华.时钟抖动对水下激光MPPM通信的误码影响分析 [J]. 激光技术, 2009,33(6): 597-597
2. 易淼.激光通信系统中多脉冲位置调制帧同步的实现 [J]. 激光技术, 2010,34(2): 164-164
3. 赵英俊.舰船激光通信中大气湍流对系统误码率的影响 [J]. 激光技术, 2010,34(2): 261-261
4. 孙丽华.LDPC码在水下激光通信中的研究 [J]. 激光技术, 2009,33(6): 604-604
5. 徐香 王平 闫颖良 王禹.低能见度下紫外光非直视传输模型研究 [J]. 激光技术, 2009,33(5): 551-551
6. 卢静.影响VCSOAs增益饱和和特性因素分析[J]. 激光技术, 2007,31(5): 496-499
7. 刘宏展.星间光通信发射终端激光耦合单元的设计及实验研究 [J]. 激光技术, 2007,31(4): 416-416
8. 柯熙政 陈丹 屈菲.RoFSO系统中4FSK仿真及其误码率性能分析 [J]. 激光技术, 2010,34(4): 0-0
9. 何华 柯熙政 赵太飞 冯艳玲.无线“日盲”紫外光网格网中的定位研究 [J]. 激光技术, 2010,34(5): 0-0
10. 王光斌 张世禄.基于变换域插值的残余码间干扰消除算法 [J]. 激光技术, 2010,34(5): 0-0