

电机与电器

基于扩张状态观测器的直驱阀用音圈电机控制系统

王大戆, 郭宏

北京航空航天大学自动化科学与电气工程学院

摘要:

基于音圈电机的直驱阀系统(voice coil motor-direct drive valve, VCM-DDV)中液动力负载扰动对系统的性能影响很大。针对此问题,在建立基于VCM-DDV系统数学模型的基础上,提出了一种位置环/电流环的双闭环控制结构,位置环采用非线性PID控制,通过扩张状态观测器得到位置反馈信号的估计及其微分,以及液动力负载等扰动的实时估计值,并对扰动进行前馈补偿。仿真及实验结果表明,该控制策略可以有效克服液动力负载对系统性能的影响,系统对位置指令响应快速且无超调,可以满足VCM-DDV系统的性能要求。该算法采用离散形式,结构简单、计算量小,便于数字控制器实时实现。

关键词: 直接驱动阀 音圈电机 非线性PID 扩张状态观测器 负载扰动

An Extended State Observer Based Control System of Voice Coil Motor Used in Direct Drive Valve

WANG Dayu, GUO Hong

School of Automation Science and Electrical Engineering, Beihang University

Abstract:

The load disturbances in a voice coil motor-direct drive valve (VCM-DDV) have greater impact on system performance. A mathematical model of the VCM-DDV was established, and a double-closed loop control structure composed of position loop and current loop was presented. A nonlinear PID was applied in position loop. An extended state observer was used to obtain the estimate signals for position feedback signal and its differential, as well as estimate signal for load disturbances. The feedforward compensation for load disturbances was implemented. The simulation and experimental results show the control strategy can effectively overcome the impact on system performance caused by hydrodynamic load. The system position response is fast and no overshoots, and can meet the performance requirements of VCM-DDV. Furthermore, the control algorithm is discrete form, simple calculation structure, and easy to implement in digital controller.

Keywords: direct drive valve (DDV) voice coil motor (VCM) nonlinear PID extended state observer (ESO) load disturbance

收稿日期 2010-08-12 修回日期 2010-09-25 网络版发布日期 2011-04-01

DOI:

基金项目:

“十一五”国家科技支撑计划重大项目(2006BAF01B10-01)。

通讯作者: 王大戆

作者简介:

作者Email: wisdom715@163.com

参考文献:

本刊中的类似文章

1. 孙凯 许镇琳 盖廓 邹积勇 窦汝振.基于自抗扰控制器的永磁同步电机位置伺服系统[J]. 中国电机工程学报, 2007,27(15): 43-46
2. 夏长亮 刘均华 俞卫 李志强.基于扩张状态观测器的永磁无刷直流电机滑模变结构控制[J]. 中国电机工程学报, 2006,26(20): 139-143

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(989KB)
- ▶ [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

- ▶ 直接驱动阀
- ▶ 音圈电机
- ▶ 非线性PID
- ▶ 扩张状态观测器
- ▶ 负载扰动

本文作者相关文章

- ▶ 王大戆
- ▶ 郭宏

PubMed

- ▶ Article by Yu,T.Y
- ▶ Article by Guo,h

