煤炭学报 2013, 38(04) 707-714 DOI: ISSN: 0253-9993 CN: 11-2190

论文

液压挖掘机工作装置的区间II型模糊控制

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摘要：

针对液压伺服系统中阀的流量非线性、泵的流量脉动、液压缸的非线性摩擦力和测量噪声等不确定性干扰因素对液压挖掘机工作装置位置控制精度的影响，建立了动臂液压驱动系统的非线性数学模型并设计了区间II型模糊控制(IT2FLC)算法。该算法将传统I型模糊集合中的隶属度值再次进行模糊化表示，即其隶属度值本身为I型模糊系统。II型模糊系统增强了集合的模糊性，从而提高了其处理不确定性的能力。仿真分析和实验结果表明，与传统I型模糊控制(T1FLC)相比，基于IT2FLC的液压驱动系统具有控制精度高、鲁棒性强、抑制干扰能力强等优点，其能有效减小输入信号突变导致的超调和振荡，并显著提高输入信号平稳变化时的跟踪精度。

关键词： 液压驱动系统；区间II型模糊控制；非线性摩擦；不确定性

Interval Type II fuzzy control on work device of hydraulic excavator

Abstract:

Based on the influences of nonlinear flow，flow pulsation，nonlinear friction，measurement noise and other uncertain disturbance factors on the position control precision of excavator work device，a nonlinear mathematical model of the boom hydraulic actuated system has been developed，and the interval Type 2 fuzzy control (IT2FLC) algorithm is designed.The membership value in the traditional Type 1 fuzzy set is fuzzified again，that is，the membership value is another Type 1 fuzzy system itself.The Type 2 fuzzy system strengthens the fuzziness of the set，which improves its ability to deal with uncertainty.Simulation analysis and experiment results show that the hydraulic actuated system based on IT2FLC has high control precision，strong robustness，strong interference suppression ability and other advantages compared to Type 1 fuzzy control (T1FLC).It can effectively reduce the overshoot and oscillations caused by the sudden change of input signals，and also significantly improve the tracking precision when the input signals vary smoothly.

Keywords: hydraulic actuated system；interval type 2 fuzzy control；nonlinear friction；uncertainty

收稿日期 2012-08-20 修回日期 2012-10-09 网络版发布日期 2013-04-25

DOI:

基金项目:

国家自然科学基金资助项目(11072190)

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