化工学报 2008 59 (7): 1737-1742 ISSN: 0438-1157 CN: 11-1946/TQ

过程系统工程

多变量多时滞非方系统的解耦内模控制

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收稿日期 2008-4-11 修回日期 2008-4-30 网络版发布日期 2008-7-15 接受日期

摘要

多变量复杂控制系统不仅具有多耦合和多时滞性，还具有结构上的复杂性，即输入输出不等，传递函数为奇异矩阵。传统的多变量内模控制是基于对非奇异对象求逆来进行的，因此很难解决这类问题。针对该情况引入矩阵论中的广义逆概念，通过求对象的广义逆矩阵来设计解耦内模控制器，打破了内模控制只能对方系统进行控制的局限性，并利用泰勒近似很好地解决了多滞后的问题，最后通过设计特殊形式的滤波器，不仅能够消除由纯滞后近似引入的不稳定极点，保证系统的稳定性，且能够保证系统的正则性。仿真结果表明，该方法不仅跟踪迅速，且继承了内模控制的无余差和强鲁棒性，动态解耦效果良好，仅对时滞变化较为敏感。由于系统基于内模控制设计，故模型匹配度越高，系统响应越好。

关键词

非方系统 广义逆 解耦 内模控制

分类号

Decoupling internal model control for multi-variable non-square system with time delays

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Abstract

A new decoupling internal model control（IMC）method was proposed for the multi-variable non-square systems with multiple time delays by introducing the conception of generalized inverse. The traditional IMC based on the inverses of nonsingular matrices was confined to square systems，so the generalized inverse was imported to design the internal model controllers by calculation in frequency domain. Time delays were approximated by the Taylor expansion diagrams. To guarantee the stability and regularity of system，special filters were designed to counteract unstable poles brought forth by the Taylor approximation. The results showed that when the model did not mis-match badly，the output curves had less than 20% overshoot and almost zero deviation from steady state. The output also had good performance about dynamic decoupling，and multiple time delays control. But the control system was sensitive to the change of time delays. Based on IMC system，the response would be better if the model matched more satisfactorily.

Key words

non-square system generalized inverse decoupling internal model control

DOI:

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