

过程系统工程

递归核PCA及其在非线形过程自适应监控中的应用

谢磊, 王树青

浙江大学先进控制研究所, 工业控制技术国家重点实验室

收稿日期 2006-8-7 修回日期 2007-4-10 网络版发布日期 2007-7-13 接受日期

摘要

PCA、PLS作为常用的多变量统计监控算法,一般适用于线性、定常的过程。针对实际工业过程的时变、非线性特性,提出了一种递归核PCA(RKPCA)方法用于非线性过程的自适应监控。RKPCA算法通过将递归奇异值分解推广到核空间,给出了核形式描述的递归KPCA算法,运算复杂度比KPCA明显降低,保证非线性监控模型能够在线更新。在Alstom工业燃气发生装置上的自适应监控表明,所提出的RKPCA算法能够及时跟踪非线性过程的时变特征,保证了监控模型的有效性。

关键词 [时变非线性过程](#) [故障检测](#) [递归核主元分析](#) [自适应监控](#)

分类号

Recursive kernel PCA and its application in adaptive monitoring of nonlinear processes

XIE Lei,WANG Shuqing

Abstract

As widely used process monitoring techniques, principal component analysis (PCA) and partial least squares (PLS) are limited to the application in linear and time-invariant systems. To handle the nonlinear and time-varying characteristics of real processes, a recursive kernel PCA (RKPCA) algorithm was proposed for adaptive monitoring of nonlinear processes. By extending the incremental singular value decomposition (SVD) to the kernel space, the kernel formulation of incremental kernel PCA, which possessed much lower computational complexity and was suitable for online model updating, was obtained. Finally, the proposed algorithm was applied to the Alstom gasifier for adaptive monitoring and RKPCA could efficiently capture the time-varying and nonlinear relationship in process variables.

Key words

[time-varying nonlinear process](#) [fault detection](#) [recursive kernel principal component analysis](#) [adaptive process monitoring](#)

DOI:

通讯作者 谢磊 leix@iipc.zju.edu.cn

扩展功能

本文信息

▶ [Supporting info](#)

▶ [PDF\(496KB\)](#)

▶ [\[HTML全文\]\(0KB\)](#)

▶ [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](#)

▶ [复制索引](#)

▶ [Email Alert](#)

▶ [文章反馈](#)

▶ [浏览反馈信息](#)

相关信息

▶ [本刊中 包含“时变非线性过程”的相关文章](#)

▶ [本文作者相关文章](#)

· [谢磊](#)

· [王树青](#)