过程系统工程

基于稀疏核主元分析的在线非线性过程监控

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摘要

核主元分析(KPCA)适合非线性过程的监控，但存在计算量大、实时性差等缺点。提出一种基于稀疏KPCA(SKPCA)的过程监控方法，先使用SKPCA对正常建模数据进行加权，少数权值大的数据基本能代表全部正常数据的信息，因此稀化了建模数据，然后根据稀化后的正常数据建立过程的KPCA模型，并提出监控指标，大大减少了计算量，提高了监控的实时性，最后以化工分离过程为对象，就KPCA与SKPCA的监控效果和实时性进行了详细的对比研究，结果表明了基于SKPCA监控方法的优越性。

关键词　　稀疏核主元分析　在线监控　非线性过程

分类号

On-line nonlinear process monitoring based on sparse kernel principal component analysis

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Abstract

Kernel principal component analysis (KPCA) is suitable for nonlinear process monitoring, but it suffers many limitations, such as great calculation load, and poor real time performance. A monitoring method based on sparse KPCA (SKPCA) was proposed to decrease calculation load and improve real time monitoring. SKPCA was firstly used to weight the normal modeling data, and the minority of data with high weight could basically represent the information of the whole data, so modeling data could be largely reduced. Following this, KPCA model and the monitoring indices were built based on the sparse modeling data. In the end, taking a chemical separation process for example, KPCA and SKPCA were compared in terms of monitoring result and real time performance, and the superiority of the proposed SKPCA method was demonstrated.

Key words

sparse kernel principal component analysis　on-line monitoring　nonlinear process

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