

过程系统工程

## 基于核Fisher判别分析方法的非线性统计过程监控与故障诊断

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**摘要** 化工过程中大量的生产数据反应了生产过程的内在变化和系统的运行状况, 基于数据驱动的统计方法可以有效地对生产过程进行监控。对于复杂的化工和生化过程, 其过程变量之间的相关关系往往具有很强的非线性特性, 传统的线性统计过程监控方法显得无能为力。本文提出了基于核Fisher判别分析的非线性统计过程监控方法, 首先利用非线性核函数将数据从原始空间映射到高维空间, 在高维空间中利用线性的Fisher判别分析方法提取数据最优的Fisher特征矢量和判别矢量来实现过程监控与故障诊断, 能有效地捕获过程变量之间的非线性关系, 通过对流化催化裂化(FCCU)过程的仿真表明该方法的有效性。

**关键词** [核Fisher判别分析](#); [非线性](#); [统计过程监控](#); [故障诊断](#)

分类号

## Nonlinear statistical process monitoring and fault diagnosis based on kernel Fisher discriminant analysis

### Abstract

The data collected from the chemical process reflect the process change and the state of the system, and the data-driven statistical method can efficiently monitor the process. However, for some complicated cases in industrial chemical and biological processes, the conventional linear statistical methods have poor ability of monitoring those processes, because the correlation between the process variables show particularly nonlinear characteristics. In this paper, a nonlinear statistical process monitoring and fault diagnosis method based on kernel Fisher discriminant analysis (KFDA) was proposed. The basic idea of KFDA is to first map the original space into a high dimension feature space via nonlinear mapping and then extract the optimal Fisher feature vector and discriminant vector to achieve process monitoring and fault diagnosis. The proposed method can effectively capture the nonlinear relationship in process variables. It was evaluated by the application to the fluid catalytic cracking unit (FCCU) model and its effectiveness was demonstrated.

**Key words** [kernel Fisher discriminant analysis](#) [nonlinear](#) [statistical process monitoring](#) [fault diagnosis](#)

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