

过程系统工程

## 基于实验设计与偏最小二乘逆模型的产品设计方法

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摘要

现代市场中, 同类产品规格多样、更新换代速度加快, 快速经济地设定新产品操作条件成为生产过程的迫切需求。本文首先改进实验设计 (DOE) 优化方法中的响应曲面法 (RSM), 可随着新实验数据的累积在线更新搜索算法的外延步长; 然后提出RSM与偏最小二乘 (PLS) 逆模型的结合方法, 可保证模型具有良好的内插和外延性能, 显著减少实验次数、快速找到满足新产品要求的操作条件; 最后通过数值仿真以及某化工过程的应用仿真验证了方法的可行性和有效性。

关键词

[产品设计](#) [实验设计](#) [响应曲面法](#) [偏最小二乘逆模型](#)

分类号

## A product design strategy based on combination of design of experiment and inversion of partial least square model

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### Abstract

Frequent product changeovers in the modern market require an efficient operating condition setup method for producing new products in the process industry. A novel product design strategy was developed based on the combination of design of experiment (DOE) and inversion of partial least square (PLS) model. The response surface methodology (RSM), a widely-used optimization method in DOE, was improved to vary the searching step-size with the accumulation of newly available experimental data. Then, the combination method of RSM and the inversion of PLS model was proposed to ensure both extrapolation and interpolation performance of the operating condition setup model. The proposed product design strategy could specify the desirable operating condition quickly and accurately with fewer new experiments in the design process. The strategy was illustrated by a numerical example and a real chemical process. Simulation results could verify its feasibility and effectiveness.

### Key words

[product design](#) [design of experiment](#) [response surface methodology](#) [inversion of partial least square model](#)

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