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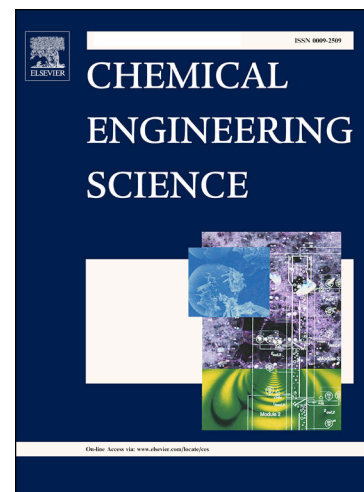
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Knowledge-data-integrated sparse modeling for batch process monitoring

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ABSTRACT: Traditional data-driven modeling methods are unable to build easily interpretable process monitoring models because they ignore the useful process knowledge. This deficiency may decrease the fault detection and diagnosis capability. To correct this deficiency, a novel knowledge-data-integrated sparse modeling method is proposed for batch process monitoring. This method builds a knowledge-data-integrated sparse (KDIS) monitoring model by integrating process data with fundamental process knowledge. The KDIS model is well suited for fault detection and diagnosis due to its sparsity and good interpretability. Based on the KDIS model, two new monitoring indices are proposed for fault detection, and two-level contribution plots are developed for fault diagnosis. Two-level contribution plots can not only identify faulty variables but also faulty variable groups corresponding to control loops or physical/chemical links in the process. The effectiveness and advantages of the proposed methods are illustrated with a case study on an industrial-scale fed-batch fermentation process.

Key words: Batch process, Process monitoring, Knowledge-data-integrated sparse modeling, Fault detection, Fault diagnosis.

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