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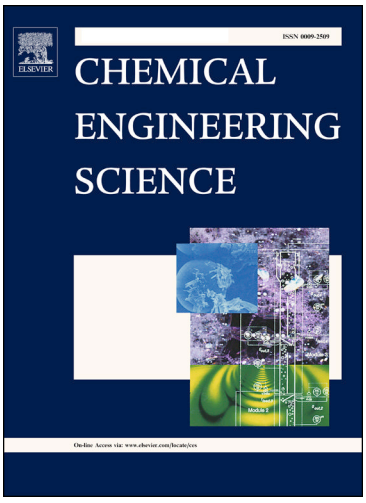

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PII: S0009-2509(18)30036-8
DOI: https://doi.org/10.1016/j.ces.2018.01.036
Reference: CES 14022

To appear in: *Chemical Engineering Science*

Received Date: 30 November 2016
Revised Date: 13 November 2017
Accepted Date: 25 January 2018

Please cite this article as: J. Liu, T. Liu, J. Chen, Sequential local-based Gaussian mixture model for monitoring multiphase batch processes, *Chemical Engineering Science* (2018), doi: https://doi.org/10.1016/j.ces.2018.01.036

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Sequential local-based Gaussian mixture model for monitoring multiphase batch processes

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Abstract: To address the incapability of using a single model to monitor multiphase batch processes with varying characteristics in different phases, a sequential local-based Gaussian mixture model (GMM) building method is proposed in this paper to improve monitoring performance. A multiphase process is divided into stable phases and transition phases in terms of the time sequence for sampling. Samples in local regions are used to partition each phase via two types of models, initial model and mixture model. Meanwhile, an adaptive iteration strategy is developed to properly determine stable phases including the in-between transition phases. Based on the partitioned phases, a localized probability index is introduced for process monitoring. A numerical example and a fed-batch penicillin fermentation process are used to demonstrate the effectiveness and merit of the proposed method.

Keywords: multiphase batch process; multivariate statistical process monitoring; sequential phase partition; Gaussian mixture model; fault detection

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