Contribution ID: **95** Type: **not specified**

In-Profile Monitoring for Multivariate Process Data in Advanced Manufacturing

Monday, 13 September 2021 16:45 (30 minutes)

Nowadays advanced sensing technology enables real-time data collection of key variables during manufacturing, which are referred to as multi-channel profiles. These data facilitate in-process monitoring and anomaly detection, which have been extensively studied in the past few years. However, all current studies treat each profile as a whole, such as a high-dimensional vector or a function, and construct monitoring schemes accordingly. This leads to two limitations. First, long detection delay exists, especially if the anomaly occurs in early sensing points of the profile. Second, analyzing a profile as a whole requires that profiles of different samples should be synchronized with the same length, yet they usually have certain variability due to inherent fluctuations. To address this problem, this paper is the first to monitor multi-channel profiles on the fly. It can not only detect anomalies without the whole profile, but also handle the non-synchronization effect of different samples. In particular, our work is built upon the state space model (SSM) framework. To better describe the between-state and between-profile correlations, we further develop the regularized SSM (RSSM). The regularizations are imposed as prior information, and maximum a posterior (MAP) inference in the Bayesian framework is adopted for parameter learning. Built upon RSSM, a monitoring statistic based on one-step-ahead forecasting error is constructed for in-profile monitoring. The effectiveness and applicability of the proposed monitoring scheme are demonstrated in both the numerical studies and two real case studies.

Keywords

In-profile monitoring, state space model, statistical process control, advanced manufacturing

Special/invited session

Data-Driven Methods for Quality Modeling and Monitoring

Primary author: ZHANG, chen

Co-authors: Dr JUAN, Du (Hong Kong University of Science and Technology); Dr LIU, Peiyao (Tsinghua University); Dr WANG, Kaibo (Tsinghua University)

Presenter: ZHANG, chen

Session Classification: Data-Driven Methods for Quality Modeling and Monitoring

Track Classification: Quality