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Industrial batch process modeling strategies and inference

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Batch processes are widely used in industrial processes ensuring repeatable transition of raw materials into the desired products. Examples include chemical reactions and biological fermentation processes in chemical, pharmaceutical and other industries.
To optimize the performance and quality of end products various data analytical approaches can be considered depending on the available descriptive data recorded during the batch run. Repeated batch runs provides three-dimensional data where one mode is batches, one mode is elapsed time per batch and one mode is the parameters measured over time. The two main approaches to structuring and modeling of batch data are time-wise and batch-wise. The different unfolding strategies have different strengths and challenges, and there is a range of approaches to allow for meaningful modeling and relevant predictions for both approaches.
The objective of this paper is to review the merits of the different methods applied for the two unfolding approaches and to provide guidance on how to successfully utilize batch modeling for different applications. Focus is on model building but operational experiences to guide real-time implementations are also shared.
Batch APC (advanced process control) is often an operational objective, and it is demonstrated how the batch modeling strategy is creating the foundation for realizing Batch APC and thus real-time benefit of data analytics.

Keywords

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