

Data Science for Batch Processes

Statistical Learning, Monitoring and Understanding

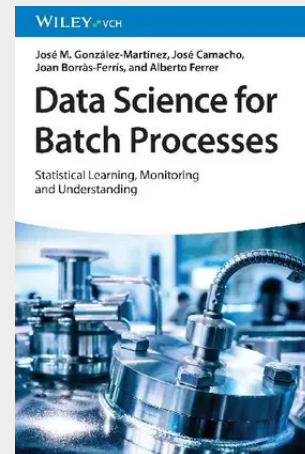
Overview of methods for bilinear modeling of batch data, including theory, methodologies and examples for experienced professionals in the biotech, pharmaceutical and petrochemical industries.

Process Analytical Technologies (PAT) have become increasingly important with the establishment of the quality-by-design paradigm in industrial processes, particularly where batch operation is standard. PAT plays an instrumental role in advancing process understanding and operational efficiency, while strengthening safety and reliability to ensure consistent on-spec product quality and minimize environmental impact. Empirical methods based on latent variables, often referred to as chemometric methods, are a main component of PAT. When used alongside Batch Multivariate Statistical Process Control (BMSPC), these methods enable the timely detection and diagnosis of process upsets. Furthermore, process understanding can be improved by applying Latent Variable Models (LVMs), such as Principal Component Analysis (PCA) and Partial Least Squares (PLS), particularly relevant in batch processes, where the inherent complexity of the model results in a high degree of uncertainty in the operation.

Data Science for Batch Processes: Statistical Learning, Monitoring and Understanding provides a comprehensive and rigorous examination of the bilinear modeling and monitoring of batch processes, comprising data alignment, pre-processing, three-way-to-two-way data transformation, data analysis and design of monitoring systems, including practical challenges and considerations when analyzing multi-dimensional batch data. Case studies and hands-on MATLAB examples using the MVBatch toolbox bridge theory and practice, illustrating how these methods can be applied.

Data Science for Batch Processes: Statistical Learning, Monitoring and Understanding is an essential guide for professionals and academics who seek both foundational knowledge and advanced techniques in batch processes and data analysis.

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