Session 2: Modeling and Control
17:40 – 18:00, 14th, July

The Impact of Process Variability on Statistical Process Monitoring

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Process simulators are widely used to develop and benchmark techniques for Statistical Process Monitoring (SPM). Typically, the simulators are deterministic and do not take process variability into account. However, modern processes in (bio)chemical industry focus on bio-based production with the help of microorganisms, and are, therefore, subject to larger inherent process variability.

In this work, the influence of process variability on the performance of SPM is demonstrated in two representative case studies by adding different levels of process variability to the well-known Pensim benchmark simulator. In the first case study, a significant improvement (i.e., decrease) of fault detection times is observed. It is hypothesized that process variability causes a persistent excitation of the process, resulting in better process monitoring. In the second case study, a slightly poorer prediction of the batch-end quality was observed for increasing biological variability.

Both case studies clearly illustrate that process variability has a profound influence on the performance of SPM techniques. When employing computer-generated data for development, testing or comparison of techniques, the use of a simulator that includes process variability is highly recommended.