An auto-framing method for stochastic process signals by using a hidden Markov models based approach

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In this work, an "auto-framing" method to divide stochastic process signals into appropriate segments is developed by a hidden Markov model-based approach. While a large number of process signals are being measured for detecting and diagnosing the state of processing equipment, their use is limited by the cost to store and analyze them. Thus, there exist motivations for classifying the time-series signals into windows of different patterns and storing only the relevant statistical information for each window. However, it is not only inaccurate but also cumbersome to perform the "data-framing" task through visual inspection.

In this work, a stochastic signal is modeled by a hidden Markov model (HMM), resulting in multiple models that switch randomly according to an underlying Markov chain. Transition points of the estimated Markov state sequence are chosen as framing points and statistical properties of each frame are analyzed and stored. We demonstrate the effectiveness of the HMM-based approach in auto-framing realistic processing data from semiconductor manufacturing processes.