PL-EWMA Controller to Mitigate Transition Effects in High-Mixed Semiconductor Production Mode for Stability Enhancement

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Abstract

Semiconductor manufacturing often operates in a high-mixed production mode, involving frequent product-type changes and the use of multiple tools. These factors lead to significant transition effects, resulting in large output deviations immediately after product-type switching. To mitigate this issue, we propose a partial likelihood exponentially weighted moving average (PL-EWMA) controller that accurately estimates model parameters and disturbances using a partial likelihood approach. This enables real-time adjustment of control inputs to maintain process stability and performance under varying production conditions. Simulation results across diverse scenarios, including parameter uncertainty and model misspecification, demonstrate that the proposed controller achieves superior stability and robustness compared with benchmark methods.

Keywords: Run-to-run (RtR) control; exponentially weighted moving average (EWMA); high-mixed production mode; partial likelihood estimation; product type changes