A Multivariate Double EWMA Process Adjustment Scheme for Drifting Processes

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Abstract

The "predictor-corrector" feedback controller, a process adjustment scheme proposed for semiconductor manufacturing run-to-run processes that drift, is extended to the multiple input-multiple output case. The controller is based on two coupled multivariate exponentially-weighted-moving-average (EWMA) equations, thus its performance depends on the choices of EWMA weight matrices. Stability conditions are given for a pure gain process adjusted with a MIMO double EWMA (dEWMA) controller. It is shown that the stability conditions are invariant with respect to various realistic drift disturbance models. Recommendations on how to choose the EWMA weight matrices are given. An analysis is conducted to assess the impact of errors in the estimates of the process gains. The proposed MIMO dEWMA feedback controller is compared to the common practice of using multiple single-input-single-output dEWMA controllers running in parallel.