

Small Sample Performance of Some Statistical Setup Adjustment Methods

Enrique del Castillo, Rong Pan and Bianca M. Colosimo

Abstract

The setup adjustment problem occurs when a machine experiences an upset at setup that needs to be compensated for. In this paper, feedback methods for the setup adjustment problem are studied from a small-sample point of view, relevant in modern manufacturing. Sequential adjustment rules due to Grubbs (1983) and an integral controller are considered. The performance criteria is the quadratic off-target cost incurred over a small number of parts produced. Analytical formulae are presented and numerically illustrated. Two cases are considered, the first one where the setup error is a constant but unknown offset and the second one where the setup error is a random variable with unknown first two moments. It is shown how Grubbs' harmonic rule and a simple integral controller provide a robust adjustment strategy in a variety of circumstances. As a by-product, the formulae presented in this paper allow to compute the expected off-target quadratic cost when a sudden shift occurs during production (not necessarily at setup) and the adjustment scheme compensates immediately after its occurrence.