On-line Process Adjustment for Asymmetric Cost Functions

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Abstract

This paper presents a feedback control rule for the machine start-up adjustment problem when the cost function of the machining process is not symmetric around its target. In particular, the presence of a bias term in the control rule permits the process quality characteristic to converge to a steady-state target from the lower cost side, thus reducing the process quality losses incurred during the transient phase of adjustment. A machining application is used to demonstrate the savings generated by the biased linear feedback adjustment rule compared to an adjustment rule due to Grubbs (1954, 1983) and to an integral (or EWMA) controller. The performance of the different adjustment schemes is studied from a small-sample point of view, showing that the advantage of the proposed rule is significant especially for expensive parts which are usually produced in small lots. In this paper, two asymmetric cost functions – constant and quadratic – are considered. Optimal biased control rules for both cost functions are derived.