The effort to achieve in-process manufacturing process monitoring capabilities that are compliant with industrial implementation constraints is leading to a continuously growing development of multi-sensor approaches.
In this frame, sensor fusion techniques may allow the achievement of required monitoring performances in terms of reliability and robustness to both disturbance factors and changing cutting conditions, and the approach becomes even more attractive when exploitable information is already available on-board, like spindle and axis drive currents and power signals. The paper presents a study aimed at dealing with the problem of monitoring the condition of the tool by using Multivariate Statistical Process Control (SPC) techniques to extract the relevant information content from multiple current signals acquired from spindle and axis drives. Usage of features that are as far as possible independent from cutting parameters, coupled with adaptive control charting methods, is proposed to cope with non-steady state conditions and signal pattern modification with different dynamics. Both static and adaptive Principal Component Analysis (PCA) based approaches are discussed, for tool breakage detection in milling of hard-to-cut materials.