On-Line Prediction of The Tool Life

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Abstract

The paper presents a new approach improving the reliability of on-line prediction of tool-life without the need of pre-process data. The aim has been to develop a robust monitoring strategy feasible for practical implementation on a CNC lathe. The tool-life is related to a selected critical point on the tool wear curve. Applied multisensing is based on the cutting force ratio correlated with in-process measurement of the flank wear by a vision system. The acquired process data are evaluated and handled by means of the modified and combined statistical methods. Initial cut is used to monitor the process and to evaluate the model parameters when critical conditions are simultaneously supervised by an additional monitoring method. The process model development, reference value setting and tool-life prediction have been automated as machine tool control features. Traditional tool condition monitoring can be improved by the reduced need of pre-process reference or machinability data, no need of calibrating procedures and, by early prediction of the tool-life with uncertainty of about 15 % after 1.5-2.0 minutes of cutting. The efficiency and flexibility of the developed method has been verified by several machinability tests performed under various machining conditions but for the same work material.