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A New Quantitative Evaluation for Characteristic of Surface Roughness in Turning

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Highlights

- The new purposed method consists in a quantitative evaluation of the difference between a real surface roughness and an ideal surface profile in turning.
- Factors that affect the cutting process stability and surface roughness are accounted implicitly by the calculated parameters.
- The surface evaluation by using the purposed method was successfully applied on three different machined surfaces.

Abstract

With turning as the aim, a method for quantitatively evaluating the stability of cutting phenomena and a machining system from the machined surface profile (primary profile and roughness profile) is proposed, based on the hypothesis that when the ideal cutting is achieved, the form of the cutter should be perfectly copied on the machined surface and the process can be replicated. Therefore, if the form and the position of the cutter (normally known) are estimated, should be possible to quantitatively evaluate the stability of the cutting phenomena, including adhesion and built-up edge, based on the difference between the actual machined surface and the position of the cutter estimated. Moreover, due to the estimated positional accuracy of the adjoining cutting edges, it should be possible to evaluate the stability of the machining system based on the vibration and the accuracy of spindle rotation. In this study, a method for estimating a cutting edge during machining from a surface profile was developed. Furthermore, the proposed method was applied to evaluate three elements: a virtually ideal machining surface with good transferability, a machining surface with poor transferability, wherein feed marks are clear, and a surface with variable transferability and feed marks due to chatter or adhesion. The results indicated that the proposed method can be successfully used to extract these characteristics.

Keywords: machining, turning, surface roughness, stability of machining, quantitative evaluation