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Effects of Tool Axis Offset in Turn-Milling Process

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Abstract

The orthogonal turn-milling process draws increasing attention parallel to the developments in multi-tasking machine tools. However, the effects of process parameters used in orthogonal turn-milling are not fully understood. The basic objective of this study is to describe one of the most important and unique cutting parameters which is the tool axis offset, and determine its effects on process outputs such as cutting force, surface quality and tool wear. In order to achieve this objective, the effect of the tool axis offset is defined based upon geometrical relationships which are used to develop a mechanistic force model. Surface quality including the tool axis offset effect is examined by both analytical and experimental methods. Additionally, tool wear experiments were conducted to obtain the tool life under different settings for the tool axis offset. It is found that the process outcomes such as cutting forces, surface quality and tool life can be improved by taking into account the tool axis offset in orthogonal turn-milling operation. As a valuable conclusion, the proposed models and experimental results can be used to select a proper tool axis offset value while performing orthogonal turn-milling process in order to improve the process outcome.

Keywords: Turn-milling; tool axis offset; cutting force; surface quality; tool wear