Machining accuracy improvement in five-axis flank milling of ruled surfaces

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Abstract

The aim of this study is to develop a new adjustment method for improving machining accuracy of tool path in five-axis flank milling of ruled surfaces. This method considers interpolation sampling time of the five-axis machine tools controller in NC tool path planning. The actual interpolation position and orientation between G01 commands are estimated with the first differential approximation of Taylor expansion. The tool swept volume is modeled using the envelope surface and compared with the design surface to determine the deviation, which corresponds to the machining error induced by the linear interpolation. We propose a feedrate adjustment rule that automatically controls the tool motion at feedrate-sensitive corners based on a bisection method, thus limiting the maximum machining errors and improving the machining accuracy. Experimental cuts are conducted on different ruled surfaces to verify the effectiveness of the proposed method. The result shows that it can enhance the machining quality in five-axis flank milling in both simulation and practical operation.

Keyword：Keywords: Ruled surface; Five-axis flank milling; Machining accuracy; Interpolation; Envelope surface