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Identification of Workpiece Location on Rotary Tables to Minimize Tracking Errors in Five-Axes Machining

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Abstract

Five-axis CNC machine tools are widely used in machining parts with free form surfaces. This paper presents optimal placement of parts on the five-axis machine tool tables to minimize the tracking errors of the rotary servo drives. The cutting forces along the tool path are first simulated at the workpiece coordinate system in Computer-Aided-Manufacture (CAM) environment. The cutting torques transmitted to the rotary and translational drives are predicted using the location of the part on the table and kinematic configuration of the machine tool. The optimal location of the part on the table is identified by minimizing the forces transmitted to the rotary drives as torque disturbances. The proposed model has been experimentally validated on a five-axis machine with tilt-table configuration. It has been shown that the tracking and contouring errors can be significantly reduced with the proposed strategy, which can be used by process planners in digital simulation environment.

Keywords: Cutting load, workpiece setup, tracking errors, five-axis, CNC machining

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