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Adaptive setup planning of prismatic parts for machine tools with varying configurations.
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Int. J. Prod. Res. 46, No. 3, 571-594 (2008).

Summary: Setup planning for machining a part is to determine the number and sequence of setups (including machining features grouping in setups) and the part orientation of each setup. Tool accessibility plays a key role in this process. An adaptive setup planning approach for various multi-axis machine tools is proposed in this paper focusing on kinematic analysis of tool accessibility and optimal setup plan selection. In our approach, feasible Tool Access Directions (TADs) of machining features are denoted by partially sequenced unit vectors; The Tool Orientation Spaces (TOS) of different multi-axis machine tools are generated according to their configurations through a kinematic model, and represented on a unit spherical surface. Starting from a 3-axis-based machining feature grouping, all possible setup plans of a given part for different types of machine tools (3-axis, 3-axis with an indexing table, 4-axis, and 5-axis machines) can be achieved effectively by tool accessibility examination. The optimal setup plans are selected from obtained candidates by evaluating both their locating and grouping factors. A so-generated setup plan can provide not only the best coverage of machining features and the primary locating directions but the optimal orientations of the work-piece for each setup. Only prismatic parts are considered in this proof-of-concept study, and the algorithms introduced in this paper are implemented in MATLAB. A case study is conducted to validate the algorithms.

MSC:

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Keywords:

setup planning; tool access direction; tool orientation space; multi-axis machine tools; machining features

Software:

Matlab

Full Text: DOI

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