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Graph-based set-up planning and tolerance decomposition for computer-aided fixture design. (English) Zbl 1060.68650

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Summary: Set-up planning plays an important role in integrating design with process planning and fixture design. Its main task is to determine the number and sequence of set-ups, and select locating datum, machining features and operations in each setup. Computer-based set-up planning may be used to generate automatically a setup plan based on tolerance analysis for minimizing locating error, calculating machining error stack-up and improving CAD/CAPP/CAFD (Computer-Aided Fixture Design) integration efficiency. Most of the current set-up planning systems were based on empirical methods (such as rule and knowledge base) and their applications background was plus/minus a dimensioning and tolerancing (GD&T) scheme. Today, more and more industries are using a true positioning Geometric Dimensioning and Tolerancing (GD&T) scheme in design and manufacturing. To support this requirement, this paper presents an analytical set-up planning approach with three techniques, (1) an extended graph to describe a Feature and Tolerance Relationship Graph (FTG) and a Datum and Machining Feature Relationship Graph (DMG), which could be transferred to an analytical computer model; (2) seven set-up planning principles to minimize machining error stack-up under a true positioning GD&T scheme; and (3) tolerance decomposition models to partition a tolerance into interoperable machining errors, which could be used for locating error analysis or for feedback to design stage for design improvement. These techniques are implemented in a computer system and it is integrated with a commercial CAD/CAM system to support an automobile manufacturing enterprise in fixture design and production planning.

MSC:

68U07 Computer science aspects of computer-aided design
90B30 Production models

Cited in **2** Documents

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