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Part Quality Prediction in Multistage Machining Processes with Fixtures Based on Locating Surfaces Using Dual Quaternions

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Abstract

The mathematical modelling of variation propagation in multistage machining processes helps to perform a quick analysis and diagnosis of the processes. The models for part quality prediction, such as Stream of Variation, include homogeneous transformations of the vectorial representations of parts and fixtures. However, these prediction models are complex when considering fixtures with locating surfaces and the associated matrix size is large. Towards mitigating the mathematical complexity, dual quaternions are proposed in representing and transforming a virtual part and fixture. To achieve this, the primary feature datum is assembled to the primary locating surface, followed by sliding the part to secondary and tertiary locating surfaces by reducing the distance between the vertices of the part and the locating surface. The prediction following the proposed approach gave a result within 0.36 % of the prediction made using CAD/CAM models and maintained the largest matrix size of 9 by 8 for a part with 9 features.

Keywords: projection of points, virtual machining, part represntation, fixture representation