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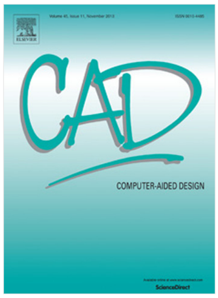

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Five-axis trochoidal flank milling of deep 3D cavities

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Abstract

Trochoidal milling is widely used in slotting and pocketing operation owing to its unique cyclic pattern that restricts the tool-workpiece engagement and hence reduces the cutting force load and helps heat dissipation. Especially when cutting extremely hard materials such as super titanium alloy, trochoidal tool path has been a good milling strategy for reducing tool wear and restraining heat generation. However, the conventional trochoidal milling is two-dimensional in nature and thus can only apply to 2.5D machining. Aiming at further extending the application of trochoidal milling, in this paper we propose a novel five-axis trochoidal flank milling strategy applicable to machining more complex 3D shaped cavities. Rather than the traditional circular trochoidal pattern, our proposed method can adaptively generate a spatial cubic curve-based cyclic five-axis tool path according to the given complex 3D cavity, and, subject to the given tool-workpiece engagement threshold, the material removal rate is maximized in the process of tool path generation. In addition, we also present a scheme of adjusting the tool orientation at the boundary surfaces of the cavity to mitigate the overcut in case they are non-developable. Both computer simulation and physical cutting experiments are conducted and the preliminary results have given a definitive confirmation on the correctness and effectiveness of the proposed method.

Keywords

Trochoidal milling; five-axis machining; slotting; tool-workpiece engagement; tool path generation

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