Simulation and Experimental Investigation of Electrochemical Trepanning of an Aero-Engine Diffuser with Different Flow Fields

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The electrochemical-trepanning process is an economical approach for manufacturing diffuser structures. In the electrochemical-trepanning process, the flow field is an important factor that affects machining stability, machining efficiency, and surface quality. In this study, two different flow fields of the forward flow-field mode and the lateral flow-field mode were proposed, and their numerical models were also established and then simulated using FLUENT software. The results showed that the flow velocity of the forward flow-field mode was higher, and the flow velocity of the lateral flow-field mode was more uniform. Furthermore, a fixture was designed to realize this new flow mode, and then corresponding experiments were carried out. The experimental results illustrated that the forward flow-field mode could get a better feed speed of 2.5 mm/min, and the lateral flow-field mode could get a better surface quality of 1.581 μm. In addition, since the lateral flow field was more uniform, the flow pattern on the machined surface disappeared, and the machining quality was greatly improved.

FULL TEXT