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CONTROLLING SHORT CIRCUITING, OXIDE LAYER AND CAVITATION PROBLEMS IN ELECTROCHEMICAL MACHINING OF FREEFORM SURFACES

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ABSTRACT

Freeform surfaces are widely used in the design of complex parts to satisfy aesthetic and functional requirements, particularly in automotive, aeronautics, and die-mould industries. Traditional machining of freeform surfaces is gradual and involves significant manual interactions. Non-traditional machining processes such as electrochemical machining (ECM) enable to increase productivity and cost effectiveness when machining of freeform surfaces as well as hard to cut materials in large scale production. However, some manufacturing problems may be arisen during ECM process and the control mechanisms for preventing such problems (short circuiting, oxide layer and cavitation problems) are very critical for achieving correct form of freeform surfaces and a complete process without any faults in ECM process. This paper firstly investigates possible causes of the ECM drawbacks such as short-circuiting, cavitation, and oxide-layer formation while ECMing of freeform surfaces and then proposed solutions in order to prevent these drawbacks are discussed. A closed-loop control system was developed using a micro-controller board in order to control short-circuiting. Flow analysis was carried out

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