Design and Simulation of a Fuzzy Logic Based Servo Controller of a Micro-Electro Discharge Machining System

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ABSTRACT

In this study, a tunable fuzzy logic controller (FLC) for monitoring and control of micro-electro discharge machining (micro-EDM) process has been developed, which uses the behavior of discharge pulses. The control parameters include gap voltage and gap current pulses. It is important to discriminate between di_erent levels of discharge pulses for proper operation of micro-EDM. Discrimination of pulses from an RC-type power source is still an ill-de_ned problem relying on heuristics.

Two approaches have been used to distinguish the pulses, that is, use of the experts'opinions that have been formed from experience and performing machining tests which in turn were used to decide on the values of the baseline data. Experiments were carried out in order to distinguish and classify the pulses through measurement and analysis of the gap pulses characteristics. The pulses were then classi_ed into open, sparking, arcing, o_ and short circuit. The classi_ed pulses were utilized as the input of the FLC that drives the servo system to maintain the desired gap width. The simulated results obtained demonstrate that the FLC is able to provide stable machining and improve the micro-EDM process.

The proposed FLC will obviate the need for skilled personnel for micro-EDM operations. The FLC will also allow high utilization of the micro-EDM apparatus and therefore reduce machining costs. There is a need for modi_cation of the existing micro-EDM by incorporating high frequency pulse generator and testing practically the e_ectiveness of the proposed controller.