

Experimental Investigation and Fuzzy-Based Modeling of Micro-EDM Process Parameters



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Abstract Micro-EDM process has become a potentially important advanced machining process for producing accurate and complex three-dimensional structural micro-features. The present paper investigates the influence of mixing of NaNO_3 salt in oxy-based de-ionized water fluid on micro-EDM performance. The D3 die steel work material was selected for hole drilling. The L9 Taguchi design was implemented for experimental design considering micro-EDM variables. Peak current, pulse-on-time and salt (NaNO_3) concentration were taken into consideration as process variables. For achieving the accurate micro-hole during micro-EDM process, the responses were selected as tool wear rate, material erosion rate, hole overcut and through-hole taper. Regression models are developed based on experimental results of responses. Further, fuzzy-based models are developed using MATLAB logic toolbox. The comparative analysis of experimental, fuzzy predicted and regression predicted was done using comparative plots. Comparative results confirm that fuzzy-based model (prediction error = 1.98%) provides better results than the regression model (prediction error = 4.87%) developed.

Keywords Micro-EDM · Fuzzy logic · D3 die steel · Dielectric fluid · De-ionized water · Taguchi method

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