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Optimization of machining parameters of WEDM for Nimonic-75 alloy using principal component analysis integrated with Taguchi method

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Abstract:

In this research, Wire Electrical Discharge Machining (WEDM) of Nimonic-75 alloy is presented to explore the significance of machining parameters such as pulse on time, servo voltage, pulse off time, peak current, wire feed rate and cable tension on performance features such as surface roughness (SR), overcut and metal removal rate (MRR). Experiments are performed according to Taguchi's L_{27} orthogonal collection. Principal component analysis is utilized for the optimization of machining parameters. The optimal settings of the machining variables obtained are pulse-on time 110 µs, pulse-off time 51 µs, servo voltage 40 volts, peak current 230 Amp., wire feed rate 5 m/min and cable tension 8 gram. Results of Analysis of Variance (ANOVA) reveal that pulse-on time (contributing 52.90%) is the major influencing factor affecting the performance characteristics. Results of the confirmation experiments indicate that the optimal machining parameters improved the value of composite primary component (CPC) from 1.2013 to 1.2443 for the multiple responses. Scanning Electron Microscopic (SEM) analysis is carried out to examine the microstructure of the machined surfaces.

Keywords: WEDM; Nimonic-75; Taguchi method; principal component analysis; composite primary component; SEM analysis.

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