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Enhancing Wire Electric Discharge Machining Efficiency through ANOVA-Based Process Optimization

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Abstract : In recent years, there has been a growing focus on advanced manufacturing processes, and one such emerging process is wire electric discharge machining (WEDM). WEDM is a precision machining process specifically designed for cutting electrically conductive materials with exceptional accuracy. It achieves material removal from the workpiece metal through spark erosion facilitated by electricity. Initially developed as a method for precision machining of hard materials, WEDM has witnessed significant advancements in recent times, with numerous studies and techniques based on electrical discharge phenomena being proposed. These research efforts and methods in the field of ED encompass a wide range of applications, including mirror-like finish machining, surface modification of mold dies, machining of insulating materials, and manufacturing of micro products. WEDM has particularly found extensive usage in the high-precision machining of complex workpieces that possess varying hardness and intricate shapes. During the cutting process, a wire with a diameter ranging from 0.18mm is employed. The evaluation of EDM performance typically revolves around two critical factors: material removal rate (MRR) and surface roughness (SR). To comprehensively assess the impact of machining parameters on the quality characteristics of EDM, an Analysis of Variance (ANOVA) was conducted. This statistical analysis aimed to determine the significance of various machining parameters and their relative contributions in controlling the response of the EDM process. By undertaking this analysis, optimal levels of machining parameters were identified to achieve desirable material removal rates and surface roughness.

Keywords : WEDM, MRR, optimization, surface roughness
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