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A Review Paper on Experimental Investigation on Spark EDM for SS 307 Material to Improve Geometrical Error Using 3d Shaped Copper Electrode

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Abstract: Electrical Discharge Machining (EDM) is a non-traditional machining process widely used for shaping hard-to-machine materials with high precision. The present study focuses on the experimental investigation of EDM performance on Stainless Steel 307 (SS 307) to minimize geometrical errors such as overcut, taper angle, and surface deviation. The experiments were conducted using 3D-shaped copper electrodes, designed to enhance spark distribution and improve flushing efficiency within the spark gap. Key process parameters including pulse current, pulse-on time, pulse-off time, and voltage were varied systematically using a Taguchi L9 orthogonal array to evaluate their influence on material removal rate (MRR), tool wear rate (TWR), and surface roughness (Ra). The results revealed that the 3D electrode geometry significantly improved dimensional accuracy and surface finish compared to conventional flat electrodes. A comprehensive investigation made on Electrical Discharge Machining parameters for improving geometrical error on complex shapes. This article includes research of various parameters like metal removal rate, tool wear rate and angularity which is essential for achieving geometrical tolerance. Complex shaped 3d copper electrode is used for machining of SS 307 steel material since copper has high electrical conductivity. Taguchi's orthogonal array analysis is adopted to find the input sparking parameters combinations like pulse on time, pulse off time, current and dielectric pressure. Experimental results shows the improve in MWR, TWR and geometrical error which can be optimized by use of EDM process.
Keywords: Stainless Steel 307, 3D Geometrical Accuracy, Geometrical Error Reduction, Dimensional Stability, Residual Stress Reduction,Thermal Stability, etc.,

1. INTRODUCTION

Electrical discharge machine (EDM) is an important 'non-traditional manufacturing method', developed in the late 1940s and has been accepted worldwide as a standard processing manufacture of forming tools to produce plastics mouldings, die castings, forging dies and etc. New developments in the field of material science have led to new engineering metallic materials, composite materials, and high tech ceramics, having good mechanical properties and thermal characteristics as well as sufficient electrical conductivity so that they can readily be machined by spark erosion. At the present time, Electrical discharge machine (EDM) is a widespread technique used in industry for high precision machining of all types of conductive materials such as: metals, metallic alloys, graphite, or even some ceramic materials, of whatsoever hardness. Electrical discharge machine (EDM) technology is increasingly being used in tool, die and mould making industries, for machining of heat treated tool steels and advanced materials (super alloys, ceramics, and metal matrix composites) requiring high precision, complex shapes and high surface finish. Traditional machining technique is often based on the material removal using tool material harder than the work material and is unable to machine them economically. An electrical discharge machining (EDM) is based on the eroding effect of an electric spark on both the electrodes used. Electrical discharge machining (EDM) actually is a process of utilizing the removal phenomenon of electrical-discharge in dielectric. Therefore, the electrode plays an important role to improve the material removal rate and electrode wear of tool material.

EDM has been replacing drilling, milling, grinding and other traditional machining operations and is now a well-established machining option in many manufacturing industries throughout the world. And is capable of machining geometrically complex or hard material components, that are precise and difficult-to-machine such as heat treated Inconel 718s, composites, super alloys, ceramics, carbides, heat resistant steels etc. being widely used in die and mold making industries, aerospace, aeronautics and nuclear industries. Electric Discharge Machining has also made its presence felt in the new fields such as sports, medical and surgical, instruments, optical, including automotive R&D areas.

II. CONCLUSION

WSN shave a wide range of potential applications. The use of these networks in the context of Big Data demonstrates their capacity to overcome inherent limitations in order to fulfil specific objectives. We anticipate a heterogeneous dataset that is constantly generated by the IoT to the point that it cannot be collected, managed, or analyzed by conventional methods in Big Data. Given their features, such data provide an intriguing challenge for LS-WSNs to acquire and analyze. We performed a thorough evaluation in this article and suggest a better method to Big Data gathering. To better address the problem of collecting Big Data, we provided horizontal overviews of WSNs and Big Data in this context. Then we looked at Big Data collecting structures and data transmission methods. Furthermore, the difficulties of collecting Big Data in LS-WSNs have been addressed. We presented a comprehensive overview of the outstanding problems with their related difficulties based on a systematic study of different writers' perspectives on Big Data gathering in LS-WSNs in order to inspire and guide future researchers.

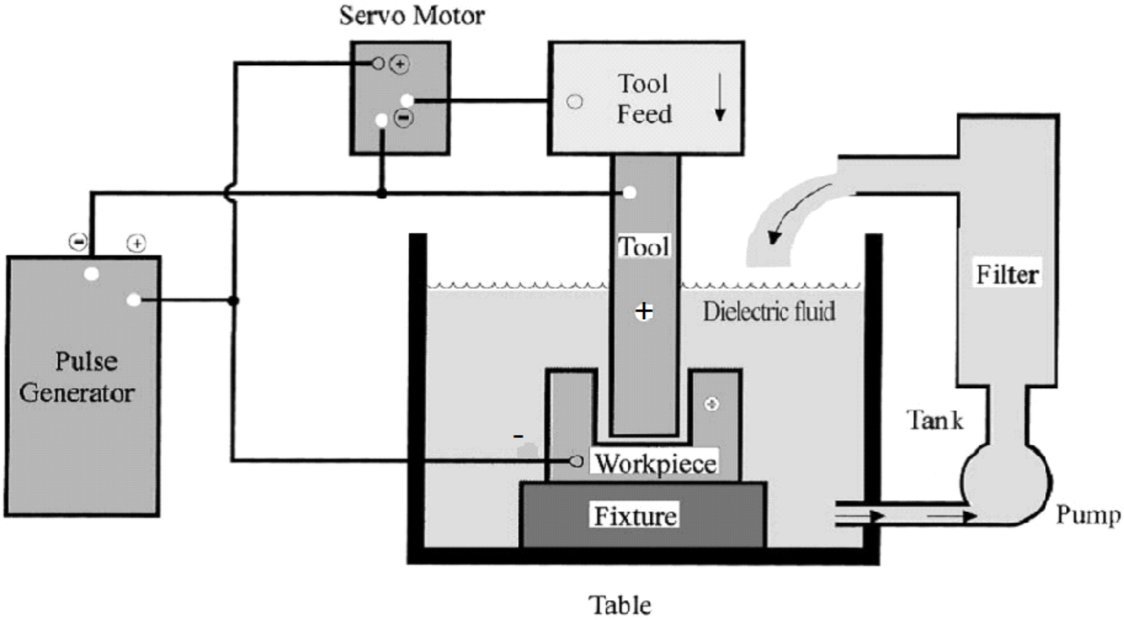

Figure 1: The above figure shows SS 307 Material to Improve Geomentrical Error

The use of SS 307 stainless steel helps improve the accuracy of components by reducing 3D geometrical errors such as distortion, misalignment, and dimensional variation. Due to its high ductility, good thermal stability, and excellent crack resistance, SS 307 can absorb thermal stresses generated during welding or fabrication processes. This reduces residual stress and deformation in the structure. As a result, components maintain better dimensional stability and improved geometrical precision. Therefore, SS 307 is a suitable material choice for applications where maintaining accurate 3D geometry and structural reliability is important.

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