ISBN: 978-81-930417-3-4

Optimization in EDM of D2 Steel with Multiple Surface Roughness Characteristics Using Hybrid Taguchi Method

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ABSTRACT

The study is done to assess the best combination of process parameters which will satisfy multiple surface roughness characteristics in Electric Discharge Machining (EDM) operation of D2 Steel workpiece by varying the tool. Direct metal laser sintered electrode using Directmetal20 has been selected along with traditionally used electrodes like coper and brass to assess the possibility of replacing these traditional electrodes by DMLS electrode. The study makes use of Principal Component Analysis (PCA) along with the Taguchi philosophy to develop a hybrid method which can answer multi-objective optimization problems. Confirmatory test is performed to validate the effectiveness of the method.

Keywords: Principal component analysis, Multi response performance index, Taguchi method, Electric discharge machining, Direct metal laser sintering.

1. INTRODUCTION

EDM is the most widely employed non-traditional machining practice which is used to machine any electrically conductive metal using thermal energy. It can easily generate any complex shape and size. A sequence of spark produced between the tool and work helps in material removal. In EDM soft metal tool electrode can machine very hard material.Number of industries does use EDM for high precession machining. Die Sinking EDM is the major EDM variant. The most common measures for surface roughness is centerline average roughness R_a measured in ìm. But considering the centerline average roughness alone may not give exact picture of surface roughness. So other important roughness parameters like R_z , R_q , R_{ku} and R_t should also be considered. So for reducing cost and time of EDM Tool production different innovative manufacturing technologies have been explored. Rapid prototyping (RP) technology is one such technology. RP is an advanced manufacturing technology where the parts are created by material additions on layer-by-layer basis. This consists of a set of approaches, wherein layer-by- layer material addition creates the required component. RP methods can be generally categorized into direct, indirect and patterns of casting [Rosochowski and Matuszak, (2000)]. The direct ones employ a RP-based procedure for direct creation of tools, while the indirect ones employ the RP process to create a pattern. This pattern is used to produce the tools. Rapid