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Multi-response optimization for milling AISI 304 Stainless steel using GRA and DFA

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Abstract. The objective of the present work is to optimize process parameters namely, cutting speed, feed rate, and depth of cut in milling of AISI 304 stainless steel. In this work, experiments were carried out as per the Taguchi experimental design and an L_{27} orthogonal array was used to study the influence of various combinations of process parameters on surface roughness (Ra) and material removal rate (MRR). As a dynamic approach, the multiple response optimization was carried out using grey relational analysis (GRA) and desirability function analysis (DFA) for simultaneous evaluation. These two methods are considered in optimization, as both are multiple criteria evaluation and not much complicated. The optimum process parameters found to be cutting speed at 63 m/min, feed rate at 600 mm/min, and depth of cut at 0.8 mm. Analysis of variance (ANOVA) was employed to classify the significant parameters affecting the responses. The results indicate that depth of cut is the most significant parameter affecting multiple response characteristics of GFRP composites followed by feed rate and cutting speed. The experimental results for the optimal setting show that there is considerable improvement in the process.

Keywords: AISI 304 stainless steel; end milling; surface roughness; MRR; GRA; DFA

1. Introduction

Austenitic stainless steels are grades of chromium-nickel steels exhibiting a very high corrosion resistance in addition to a wide range of excellent mechanical properties not offered by any other alloy. Austenitic stainless steels cannot be hardened by traditional heat treatment processes but they can be strengthened by cold working (Peckner and Bernstein 1977). AISI 304 steel is hard to machine due to their high strength, high ductility and low thermal conductivity, high tensile strength, high fracture toughness and high work hardening rate. Machining operations of austenitic stainless steels are usually accompanied by a number of difficulties such as irregular wear and built-up-edge on the tool flank face and crater face, respectively (Kosa 1989, Groover 1990). The present of built-up-edge will cause an increase in tool wear rate and deterioration of the surface integrity of the work.

The surface roughness (Ra) and material removal rate (MRR) have been identified as quality

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Yang, W.P. and Tarng, Y.S. (1998), “Design optimization of cutting parameters for turning operations based on the Taguchi method”, *J. Mater. Process. Tech.*, **84**(1), 122-129.

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