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Reducing Cutting Forces and Surface Roughness in Turning Operations by Multi-Objective Optimization of Cutting and Geometric Characteristics

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Abstract: *One of the most crucial machining operations that must be performed in a variety of sectors in order to manufacture a wide range of products is turning. Optimizing the several elements impacting turning operation is crucial for the best operating conditions because it is a fundamental operation for many industries. Both geometrical and cutting characteristics have an impact on turning operations. Cutting velocity, depth of cut, feed rate, and cutting tool geometry such as nose radius, rake angle, and principal cutting edge angle are the parameters that have the biggest effects. Since the product with the intended qualities depends on these characteristics, it is imperative to manage surface roughness and cutting force acting on material during turning operations. Finding the ideal values for various cutting parameters, such as cutting speed, depth of cut, feed rate, and principle cutting edge angle, in order to minimize cutting force and surface roughness, is the project's goal. WC inserts are used as a tool in the project to turn 304 SS as the work component. The following cutting settings are chosen: depth of cut (0.5, 0.6, 0.7 mm), feed rate (0.105, 0.166, 0.25 mm/rev), cutting speed (13.18, 20.724, 33.912 m/min), and principle cutting edge angle (78, 66, 62 degrees). Taguchi's L9 orthogonal array architecture serves as the basis for the design and execution of various experimental combinations. After normalizing the output response values for the lower-the-better condition, grey relational coefficients are calculated, and a grey relation grade is then obtained. The best amounts of the input parameters are determined by plotting the S/N ratio in MINTAB 16 after grey relation grade values are converted to S/N ratio for larger-the-better conditions. To validate the experimental outcome, a confirmation test is performed for the ideal level of input parameters.*

Keywords: turning