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Multi-objective optimization of cutting parameters to minimize power consumption in dry turning of stainless steel 316

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ABSTRACT

The machinability of stainless steel has attracted considerable interest because of its high strength and corrosion resistance. Cutting fluids-based oil are the most unsustainable elements of machining processes, it is negatively affect the environmental impact of a process. Therefore, dry machining is the optimum solution, when applicable. Reducing energy consumption and using low-cost cutting tools under dry condition should considered for sustainable machining. Therefore, this study aims to optimize machining parameters, including power consumption and the traditional machining responses of surface roughness and tool wear. Stainless steel was turned with an uncoated carbide tool under dry conditions. A multi-objective optimization method of Response surface methodology was employed to optimize machining parameters. The significant contribution of parameters was determined on the basis of compound desirability value, and optimal levels of the parameters were identified. A confirmation test was conducted to validate results. This combination of parameters resulted in the minimum power consumption of 14.94% and decreased surface roughness and tool wear by 4.71% and 13.98%, respectively. Therefore, this method also effectively reduces the effects and costs of the machining process.

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