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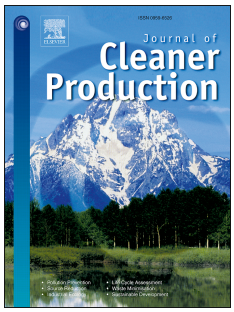

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Power Consumption and Tool Life Models for the Production Process

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Abstract

For achieving the multi-objective optimization of product quality and power consumption of any production process, the formulation of generalized models is essential. Extensive research has been done on applying the traditional statistical methods (analysis of variance, response surface methodology, grey relational analysis, Taguchi method) in formulation of these models for the processes. In the present work, a detailed survey on the applications of these methods in modelling of power consumption for the production operations specifically machining is conducted. Critical issues arising from the survey are highlighted and hence form the motivation of this study. Further, three advanced soft computing methods, namely evolutionary-based genetic programming (GP), support vector regression, and multi-adaptive regression splines are proposed in predictive modelling of tool life and power consumption of a turning phenomenon in machining. Statistical comparison based on the five error metrics and hypothesis tests for the goodness of the fit reveals that the GP model outperforms the other two models. The hidden relationships between the process parameters are unveiled from the formulated models. It is found that the cutting speed parameter is the most influential input for power consumption and tool life in the turning phenomenon. The future scope comprising of the challenges in predictive modelling of production processes is highlighted in the end.

Keywords: power consumption; machining; environmental; tool life; soft computing methods; genetic programming

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