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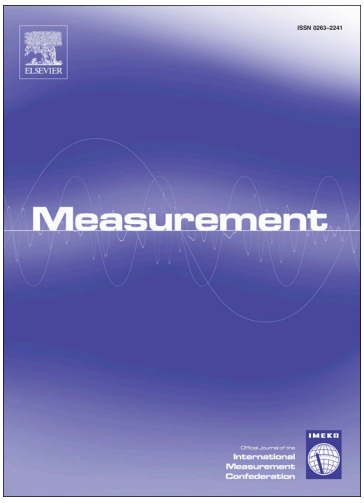

Advancement of an intelligent system based on ANFIS for predicting machining performance parameters of Inconel 690 - A perspective of metaheuristic approach

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Advancement of an intelligent system based on ANFIS for predicting machining performance parameters of Inconel 690 - A perspective of metaheuristic approach

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Abstract

The convincing potential of sophisticated milling tools exploited for machining of Inconel alloys in CNC milling machine offers minimal surface roughness-cutting force-cutting temperature trade-off footprint as compared to the conventional machining operation, which afforded a strong motivation to accomplish an in-depth discovery of the parametric design of CNC milling operation. In this study, the synergistic potential of contemporary Cubic boron nitride coated tool is used for machining of Inconel 690 in CNC milling machine, which has been scrutinized in order to build up a correlation among the objective function and the control variables by a metamodel called Adaptive Neuro-fuzzy inference system (ANFIS). The developed ANFIS model was capable of predicting the performance parameters with commendable accuracy as observed from correlation coefficients within the range of 0.946542-0.988996, Mean absolute percentage error (MAPE) in the range of 3.879652-7.456275% along with noticeably low root mean square errors (RMSE). Moreover, the ANFIS acquired results were compared with an Artificial Neural Network (ANN) model, developed on the identical parametric ranges. The comparison of the obtained results indicated that the ANFIS overtakes the ANN model in predicting the preferred response variables, which suggests the modesty of the ANFIS model.

Keywords: Inconel 690; Dry milling; Cubic boron nitride *(*CBN) coated tool; Response surface methodology (RSM); Machine learning; Adaptive Neuro-fuzzy inference system (ANFIS), Statistical evolution.

1. Introduction

Heat resistant super alloys like Inconel is frequently employed in crucial structural elements of aircraft engines owing to its benefits at elevated temperatures. In order to acquire the finishing part, these structural elements have to be machined successfully; therefore, the surface integrity subsequent to machining turns out to be a vital concern. Conversely, its tremendous mechanical assets such as elevated fatigue strength, superior corrosion resistance and strong creep resistance quality were conferred by means of appreciable work hardening capacity, elevated temperature

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