Application of ANFIS approach for prediction of performance measures in wire electric discharge machining of SAE 1010

Conference Proceeding Published: 03 August 2024

Volume 245, article number 193, (2024) Cite this article

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Abstract

Due to its exceptional quality, SAE 1010 is highly recommended for automotive applications, particularly in the manufacturing of headed fasteners and bolts. The primary application of this technology is in automobiles, while it also holds significant potential for various other technological disciplines. Utilizing alternative techniques for removing material has proven to be essential in overcoming numerous machining challenges that were previously difficult to solve. It possesses numerous practical applications in aircraft engineering and exhibits significant potential for implementation in other technical domains. Manufacturing complicated curved components using traditional machining methods might provide challenges. In order to prevent such issues,

a wide range of cutting-edge machining methods have been developed. Wire Electrical Discharge Machining (WEDM) is a variance of Electrical Discharge Machining (EDM) that is suitable for this particular use. This study employs Taguchi's technique to examine the Wire Electrical Discharge Machining (WEDM) of SAE 1010 steel from an environmentally friendly viewpoint by employing a natural dielectric fluid in order to minimize its ecological footprint. This study aims to optimize the process variable and develop a hybrid predictive model based on grey approach for foretelling the necessary performance measures by considering various performance metrics, including material removal rate, surface roughness, and tolerance errors. The significance of process variables has been determined with the help of Analysis of variance (ANOVA) and it is inferred that pulse on duration is the most contributing factor for all the desired performance measures. A hybrid technique was used by an artificial intelligence technology to project the selected output measure. The outcomes on performance of the evolved ANFIS model shows the prediction capability of the model developed with least errors (MAPE – 0.0417, RMSE - 0.00023, MAE – 0.000419, Correlation coefficient 0.9997). The outcomes of the analysis indicate that the model is both efficient and accurate in its predictions, could be valuable to the manufacturer since it establishes targets for important performance indicators.

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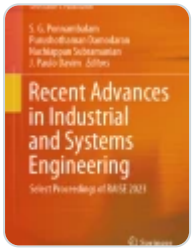

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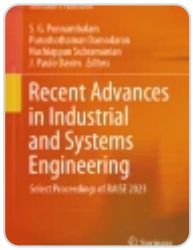

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Data availability

No datasets were generated or analysed during the current study.

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Contributions

P. Thejasree, N. Manikandan, Neeraj Sunheriya, Jayant Giri: Wrote the paper with input from all authors, Contributed to the design and implementation of research, to the analysis of result and to the writing of the manuscript.T.Sathish, Rajkumar Chadge: Contributed to the design and implementation of research.Chetan Mahatme, A.Parthiban: Contributed to the design and implementation of research.

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Ethics declarations

Ethical approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing of interest

The authors declare no competing interest.

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Cite this article

Thejasree, P., Manikandan, N., Sunheriya, N. *et al.* Application of ANFIS approach for prediction of performance measures in wire electric discharge machining of SAE 1010. *Interactions* **245**, 193 (2024). https://doi.org/10.1007/s10751-024-02030-9

Accepted
23 July 2024

Published
03 August 2024

DOI
https://doi.org/10.1007/s10751-024-02030-9

Keywords

WEDM SAE 1010 Taguchi's method GRA Optimization Artificial intelligence ANFIS