Review of: "Optimized Material Removal and Tool Wear Rates in Milling API 5ST TS-90 Alloy: AI-Driven Optimization and Modelling with ANN, ANFIS, and RSM"

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Potential competing interests: No potential competing interests to declare.

This article describes the optimization of the Material Removal Rate (MRR) and Tool Wear Rate (TWR) using the response surface method (RSM) and AI-based models of artificial neural networks (ANNs) and adaptive neuro-fuzzy inference systems (ANFISs) for milling API 5ST TS-90 alloys. Central Composite Design (CCD) in Design Expert 14 software was adopted. The optimum process milling parameters for the alloy were also determined.

Introduction. Since high productivity, good surface finish and optimum tool life are of greatly importance in all types of machining operations.In general, selection of milling parameters is largely rely on the experience of the machinist or required data obtained from machine tool's handbooks, but it has got some uncertainities. Limited numbers of research are reported to carry out on MRR and TWR like Shukry et al. (2018), Sandeep et al. (2019), while ANN by Salimiasi and Özdemir (2016), Bagga et al. (2021) for TWR, and RSM by Zhang et al. (2019) for MRR, Wickramarachchi et al. (2021) for TWR and Hsu & Ngayen (2017) for MRR. Thus, manufacturing engineer should be determined optimum milling process parameters using different methodology such as RSM,ANN and ANFIS methodologies,which are right due to economical benefit and scientific approaches because getting the accurate results. The purpose of this work is to model/optimize MRR and TWR for milling API 5ST TS-90 alloys using RSM, ANNs and ANFIS, respectively, results are compared to each others.

Materials/metod. As a working material, API 5ST TS-90 hollow cylindrical alloy steel (Ø38.1 mm outer, Ø31.75 mm inner), respectively, with 50 mm length bar are selected. Chemical composition and mechanical properties of the specimen are shown in Tables 1 and 2, respectively. Table 1 elements must be separated from each other with clearly,which is confused at the moment. The cutting tool was four-flute made of HSS tool with a hardness of 67 HRB. However, the hardness of the tool in Table indicates 97HRB,which is wrong should be corrected.Table 3 shows ZX6350C milling machine specification, there is no advantage, do not used any data or graph which can be removed.

Research design section is OK because CCD was used as a RSM model. 20 experimental runs was carried out based on input parameters (depth of cut, feed rate and spindle speed). For MRR,Eq.(1), Eq.(2) is used, Eq.(3) seems to be right, but not logical I suppose because Li-Lf/t, that is very rough approach. Cutting tool hard material as he already stated 67 HRB. So it is not wear out easily when they cut the steel. In a practically, it is normally measured by flank wear of any types of cutting tools through optical microscopic examination. According to ISO 3685,tool life/wear criteria and their definition are given in a detailed way. Tool wear is defined as the change of shape of the tool from its original shape, during cutting. Flank wear criteria is accepted as 0.3mm if it is formed uniformly, if not formed uniformly, 0.6mm accepted as a wear rate. The tool are cut/use both peripherically and profile face not only cutting face/cutter end. He said that it is meassured with vernier calliper,which is quite approximate method. Here; Li(mm) is the length of the cutting tool before milling,which is OK, but Lf(mm) is the length of the cutting tool after milling ,which is not right todo so.

Analytical Tool/Method of data analysis is OK. Response surface method (RSM), ANN and ANFIS formulations is OK. Statistical error indicators used for evaluation of the RSM, ANN and ANFIS Models is OK.

Results and discussion. First of all, the derived quadratic model was formed as Eq. 27. The equation was used to model MRR when milling API 5ST TS-90 alloy using three main parameters. The predicted R^2 and adjusted R^2 values (99.51&99.92%) showed acceptable significance; hence, the quadratic model suggested was adequate. ANOVA confirmed the model and process parameter. Three parameters were a significant influence on MRR.For TWR, the value of adjusted R^2 was 0.9859 while the predicted R^2 was 0.9629,respectively. Eq.(28) generated but in this model interacting variables AB & AC were in- significant. Therefore, by elimination of these factors, the reduced model is formed as Eq.(29). A,B,C factors also effective on the response, order of effectiveness is as fllows: feed rate > depth of cut > spindle speed. ANN modelling for MRR & TWR, ANFIS modelling for MRR&TWR is OK. Table 8&9 show the ANFIS model structure for MRR and TWR covering experimental data and residuals as well and comparison to other models. Further, Table 10 indicates the Statistical indicators for RSM, ANN, and ANFIS for MRR and TWR.

From all these table &figure results revealed that the ANFIS model gave marginally better (1.0&0.998) MRR and TWR predictions than ANN (0.986&0.892) and RSM, while RSM (0.999&0.948) gave a better prediction than ANN (R^2), which is surprised me in fact. Finally, optimization of the milling process was performed. The optimum milling parameters for MRR and TWR were provided. The validation of the milling process was performed at suggested conditions and the results showed a close correlation between the predicted and validated optimum values.

To summarize, the methods applied such as RSM,ANN &ANFIS was explained in a logical way. A lot of results and data were provided in accordance with standard that support any conclusions indicated directly. There are a lot of results and conclusions introduced here. As an ethical point of view, the study's design, data presentation, and citations complied with standard COPE ethical guidelines and no such an ethic problem appeared. However, the results obtained here was very theoretical. What do I expect ? At least in confirmation section of max MRR or min TWR, some experiments/micro-surface examination using optical or SEM examination should be taken for tool or chip geometry to see the different mechanisms of wear.

This study had an original data, processes and results using advanced analytical techniques like RSM;ANOVA;ANN&ANFIS. The results were also confirmed with these extra runs. I hope that it provided quite high standard among these types of studies carried out previously. Therefore, it is quite appropriate for publication of your well-known international journal.

My score is about 4 (near excellent) due to being very theoretical not indicating any responssible mechanism.

Yours Sincerely,

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