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Peer Review

Review of: "Uncertainty-Driven Modeling of Microporosity and Permeability in Clastic Reservoirs Using Random Forest"

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General Assessment:

The manuscript addresses an important area in manufacturing engineering by investigating the influence of coated and uncoated carbide inserts on surface roughness and cutting forces during the turning of EN36 alloy steel. The topic is relevant, and the paper presents a practical approach using Taguchi and ANOVA methodologies. The experimental work is methodically presented, and the results are generally consistent with the literature. However, there are several areas where the paper can be improved for greater clarity, rigor, and scientific contribution.

1. Novelty and Contribution

- **Strengths**:

  The study investigates the effects of coated vs. uncoated carbide inserts on machining parameters of EN36 steel—a material less commonly examined in recent literature compared to standard steels. The use of both Taguchi design and ANOVA adds value to the analysis.
- **Limitations in Novelty**:

The novelty is somewhat limited due to the widespread use of Taguchi and ANOVA in similar machining optimization studies. The contribution could be strengthened by highlighting the uniqueness of the coating material, machining strategy, or detailed comparative analysis with recent advanced optimization techniques (e.g., genetic algorithms, response surface methodology, machine learning).

2. Methodology

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- The methodology is adequately described, but further clarity on the selection rationale for machining parameters (speed, feed, depth of cut) would be beneficial. Reference to industry standards or preliminary studies supporting the chosen parameter levels is recommended.
- Include more information about the coating type (TiN, TiAlN, etc.) and deposition method, as these significantly affect tool performance.
- The experimental setup figure is helpful. However, it would be beneficial to include a schematic or clearer image to enhance reader comprehension.

3. Results and Discussion

- The results are presented clearly using appropriate tables and graphs. However, the discussion lacks depth in some sections. For example, the influence of tool coating on surface roughness could be better supported with metallurgical or thermal reasoning.
- The regression models (Equations 4 and 5) should include validation statistics such as R^2, adjusted R^2, and p-values to assess their predictive quality.
- The confirmation test is well-designed but should report the percentage error or confidence interval to quantify accuracy.

4. Limitations of the Study

- The study does not address tool wear progression or temperature effects, which are crucial in real machining environments.
- Only one type of workpiece material and a limited range of cutting parameters are considered. These factors limit the generalizability of the findings.
- Surface integrity aspects (e.g., microhardness, residual stress) were not examined, which could further differentiate the performance of coated vs. uncoated tools.

5. Language and Presentation

- The manuscript is generally well-written but would benefit from careful proofreading for grammar and sentence structure. Examples include:
  - "The values of response parameters are..." → consider "The measured response parameters are..."
  - "It is revealed that..." → consider "The results indicate that..."
- Avoid redundant phrases and improve transitions between sections to enhance the manuscript's flow.

6. Suggestions for Improvement

- Emphasize the novelty by comparing your results with recent cutting-edge studies from the past 3–5 years.
- Provide more detailed information about the coating material and its properties.
- Enhance the discussion section by integrating material behavior, tool-workpiece interaction, and thermal effects.
- Consider adding statistical validation metrics for your regression models.
- Include additional limitations and suggest broader applicability or industrial relevance.

7. Suggestions for Future Work

- Investigate the performance of different coating materials (e.g., TiAlN, AlCrN) under varying lubrication/cooling conditions.
- Expand the study to include tool wear, cutting temperature, and chip morphology analysis.
- Explore hybrid optimization approaches (e.g., Taguchi–GA, ANN–Taguchi) for improved prediction and control.
- Study the machining performance on other hard-to-machine alloys or under high-speed machining conditions.

Recommendation:

Moderate Revision

The manuscript is well-structured and contributes to the field of machining optimization, but it requires moderate revisions for clarity, better contextualization, and methodological robustness.

Declarations

Potential competing interests: No potential competing interests to declare.