INFORMATION ON THE DOCTORAL DISSERTATION

Full name of the doctoral candidate: **Hoang Anh Toan**

Dissertation title: **"Investigation of the Effects of Selected Technological Parameters on Productivity and Quality in the Hard Milling of External Cylindrical Surfaces Using Minimum Quantity Lubrication with CuO Nanoparticles".**

Discipline: Mechanical Engineering

Discipline code: 9520103

Full names of the academic supervisors:

1. Prof. Dr. Vu Ngoc Pi
2. Assoc. Prof. Dr. Hoang Van Got

Training institution: National Research Institute of Mechanical Engineering – Ministry of Industry and Trade

SUMMARY OF THE DISSERTATION'S NOVEL FINDINGS

1. Scientific significance

The dissertation contributes to clarifying the mechanisms by which technological parameters and nano-MQL conditions affect the hard-milling performance of 90CrSi steel using a nano-composite-coated carbide end mill. In addition, the dissertation proposes an integrated RSM–GPR–NSGA-II–AHP methodological framework for multi-objective optimization, thereby contributing to the methodology of precision mechanical machining.

2. Practical significance

The research results provide a scientific basis for selecting appropriate hard-milling conditions for contoured cylindrical surfaces made of 90CrSi steel using a nano-composite-coated carbide end mill in industrial production. The proposed multi-objective machining conditions help balance surface quality and productivity while reducing cutting forces, thereby contributing to improved economic efficiency and the sustainability of the machining process.

3. Novel contributions of the dissertation

- A systematic investigation of the hard milling of the external cylindrical surface of 90CrSi steel using a six-flute nano-composite-coated carbide end mill under CuO-based nano-MQL conditions.

- Development of RSM models to predict Ra, MRR, and F.

- Application of NSGA-II in combination with GPR for multi-objective optimization of the hard-milling process.

- Integration of the AHP method and the Knee point to select the overall optimal machining conditions.

- Proposal of balanced machining conditions validated through experiments.

- Application of the multi-criteria decision-making methods TOPSIS, MARCOS, and EAMR to select the optimal solution from the feasible Pareto solution set.

Hanoi, October 15, 2026

Comments of the Academic Supervisors **Doctoral Candidate**

Prof. Dr. Vu Ngoc Pi **Assoc. Prof. Dr. Hoang Van Got** **Hoang Anh Toan**