Labor für Fertigungstechnik und Werkzeugmaschinen
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Technische Hochschule Rosenheim

Master's Thesis Announcement

Generative AI for NC Programming: Experimental Comparison of AI-generated and Conventionally Created CNC Programs in the Laboratory for Manufacturing Technology and Machine Tools (LFW)

Faculty:
Faculty of Industrial Engineering,
Technische Hochschule Rosenheim

Start:
Immediately or by arrangement

1. Background and Task Description

Creating NC programs for machining is time-consuming and requires experienced specialists, who are increasingly scarce. Generative AI promises to change this: in 2025, Siemens founded a data alliance together with leading machine tool manufacturers such as Trumpf, Grob, Chiron, Heller and Renishaw as well as the Machine Tool Laboratory (WZL) of RWTH Aachen. One of its goals is to generate NC programs automatically with an industry-specific AI model. At the same time, the German machine tool industry is undergoing structural change, in which AI-based production solutions are seen as a decisive competitive factor.

It is still largely open how good AI-generated NC programs really are, where they save time and where they fail. The LFW at TH Rosenheim offers ideal conditions for an independent investigation: modern machine tools and a Siemens Industrial Edge environment with which machine and process data can be recorded during machining.

2. Objective

The aim of this thesis is to systematically compare NC programs created with generative AI with manually and CAM-based programs in laboratory experiments with regard to quality, time savings and process reliability, and to derive the limits of the technology and guidelines for its use.

3. Tasks

1. Literature and technology review: State of the art on AI in NC programming and CAM, including available tools (e.g. general-purpose LLMs, manufacturer assistants, CAM plug-ins).
2. Design of experiments: Selection of three to five reference parts (milling and/or turning) of increasing complexity and definition of evaluation criteria and KPIs.
3. Program generation: Creation of NC programs for each reference part by (a) manual programming, (b) CAM-based programming and (c) generative AI, with documented prompts and effort.
4. Verification: Checking all programs in simulation for collisions, syntax and plausibility, and documenting the required corrections.
5. Machining experiments: Machining of the reference parts on the laboratory machines, recording process data via the Industrial Edge environment and measuring dimensional accuracy and surface quality.
6. Evaluation: Comparison of programming time, error rate and correction effort, machining time, part quality and process stability.
7. Guidelines and outlook: Derivation of application limits, safety requirements and recommendations for the use of generative AI in NC programming, as well as potential uses in teaching and industry.

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4. Expected Results

A documented experimental comparison of AI-generated and conventionally created NC programs, a validated set of reference parts and evaluation criteria that can be reused in the LFW, an assessment of the strengths and limits of generative AI in NC programming, and practical guidelines for its use.

5. Your Profile

You are enrolled in a master's programme in industrial engineering, mechanical engineering, mechatronics, production engineering or a related field. You are interested in manufacturing technology, machine tools and artificial intelligence, especially large language models. Basic knowledge of NC programming and CAM is required; experience with Siemens Sinumerik, Industrial Edge or metrology is an advantage. You work independently and in a structured way, and you enjoy combining practical work on machines with systematic evaluation.

6. Language

The thesis can be written in English or German.

7. Contact

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