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Date: 9/11/25
Subject: Homework 1: Self-Learning Report

Introduction to CNC Lathe Machining for Capstone Project

Introduction

For my ME 486C self-directed learning, I learned CNC lathe operation and process planning to support our team's need to machine the generator casing and the shaft. Developing competency on the CNC lathe strengthens my skills in design for manufacturability, geometric dimensioning & tolerancing, and inspection. This is directly tied to our generator's performance and assembly process.

Learning Process



Figure 1 Final Machined Pieces

I completed NAU 98C Machine shop CNC lathe orientation on September 5, 2025. Over a total of nine hours of supervised practice on the CNC lathe, I learned chucking and fixturing, performed tool touch-off.

In terms of workflow, I focused on three jaw chuck operations for central work holding. I used a parting/grooving tool and a center drill with a live center for long shafts. I practiced facing, rough and finish turning, grooving, threading, and drilling cycles. As part of this work, I

produced my first external right-hand threads with a 60° profile on a steel coupon and verified them with a thread gauge.

For programming and parameters, I applied the cutting-speed relation, selecting lower SFM for steels and higher SFM for aluminum and reducing SFM for harder or unknown materials. I planned chip load and depth-of-cut with a rough-then-finish approach. Coolant management and sharp inserts helped avoid built up edge and overheating towards the tools in aluminum and steel.

For inspection and quality, I measured OD with calipers, the final piece of the aluminum was 0.800 inches with tolerance of -0.025 inches and for the steel the final OD was 0.75 inches with a tolerance of ± 0.025 inches.

Application to Capstone Project

Mastering the CNC lathe reduces risk in our design by making the shaft and casing both machinable and reliable. Learning operations like roughing, finishing, threading, and boring shows what tolerances, surface finishes, and runout are realistically achievable in the shop. This directly improves our purchasing of materials by making them manufacturable.

On the functional side, better concentricity and surface finish stabilize the magnetic air gap, reduce vibration, and extend bearing life, while threading ensures secure rotor and hub retention. For the casing, practice with boring and facing informs wall thicknesses, register features, and tolerances that keep the generator stack-up consistent and easy to assemble.

Overall, this hands on experience leads to cleaner assemblies, faster iteration, and more realistic vendor specifications, while also giving us the ability to prototype parts in house for direct testing and validation.

References

[1] Northern Arizona University, “98C Machine Shop Advance Training,”