Naomi Echo

ME 486C

Self Learning

Due 9-12-25

Introduction

In this deliverable the self learning I did to benefit my capstone project will be explained. Due to the complications with the dynamometer in our project I have taken on an additional role of being a CAD engineer. Due to these additional responsibilities I needed to make major revisions to the design of our generator, which includes doing drawings and finalizing the different types of fit that will be necessary. For my self-learning assignment I decided to do a course on Udemy called "Basics of Tolerance Stack-up Analysis and Fits with GD&T"[1] to better my knowledge to be able to create a high quality product. I spent three hours and 20 minutes completing the course as can be seen below:

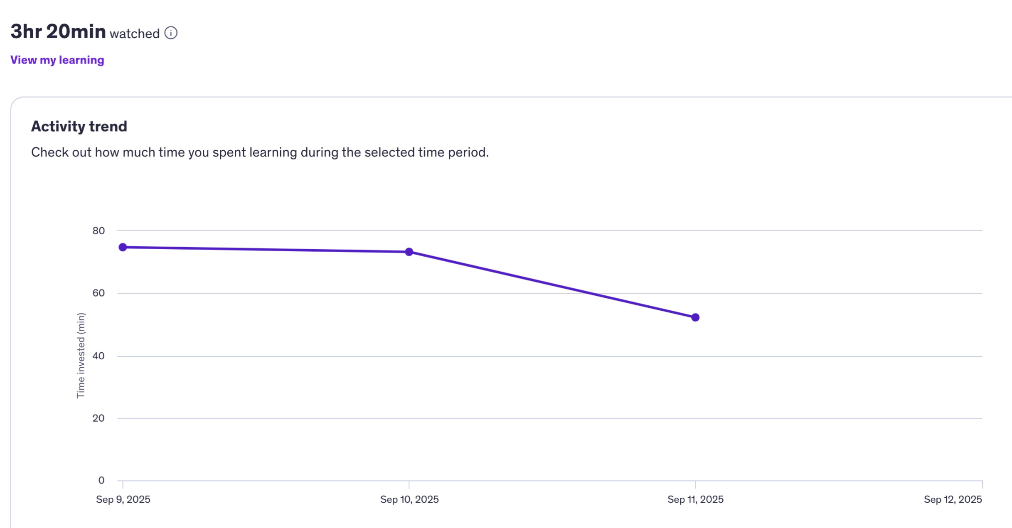

Figure 1: Proof of Time Spent on Self Learning

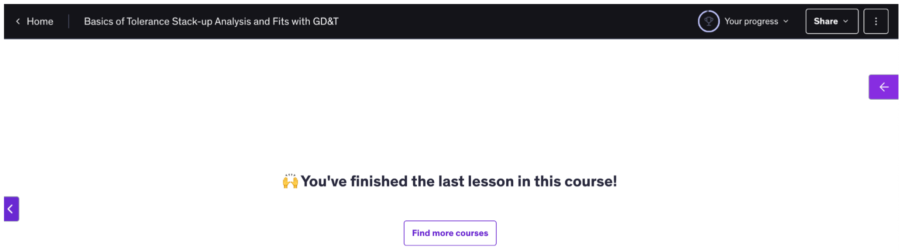

Figure 2: Proof of Course Taken

Application

Within our generator there are 4 main parts; rotor, lamination stack, stator, and shaft. Figure 3 below shows the entire assembly.

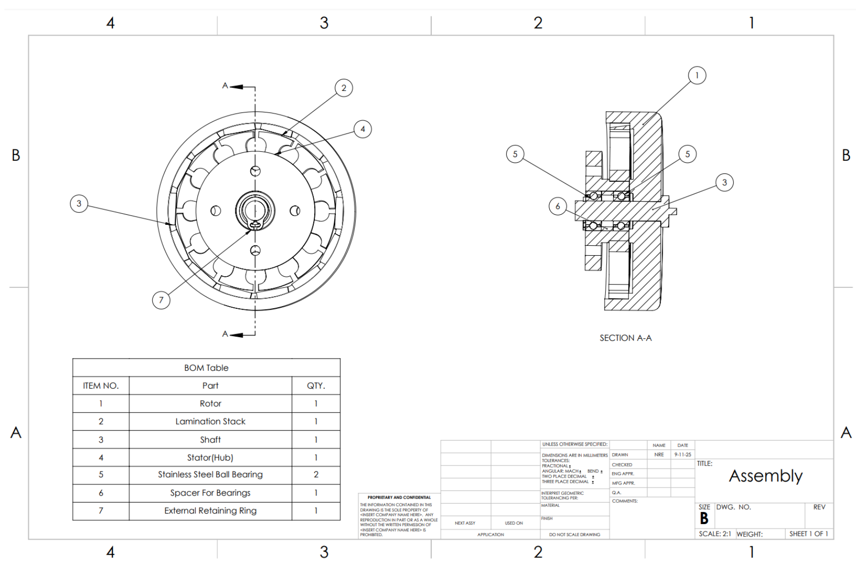

Figure 3: Drawing of Assembly

As seen in Figure 3 the shaft is an interference fit to the bearings in the stator and within the rotor. The tip of the shaft that is fitted in the rotor will experience a large amount of torque. Due to this a press fit would not be a good fit, alternatively a shrink fit will help with standing the torque being applied much better. A shrink fit uses thermal expansion to strongly secure two pieces of metal together. In this case the rotor will be heated as the bore expands and the shaft will be cooled so it shrinks. After both parts are back at room temperature the fit will be extremely secure. The fit between the bearings and shaft will be a press fit because a shrink fit would run the risk of the rubber cracking within the bearing.

In order to achieve the appropriate fits within the design the parts need to be machined to certain tolerances. Figure 4 below shows the drawing of the rotor with dimensions and associated tolerances.

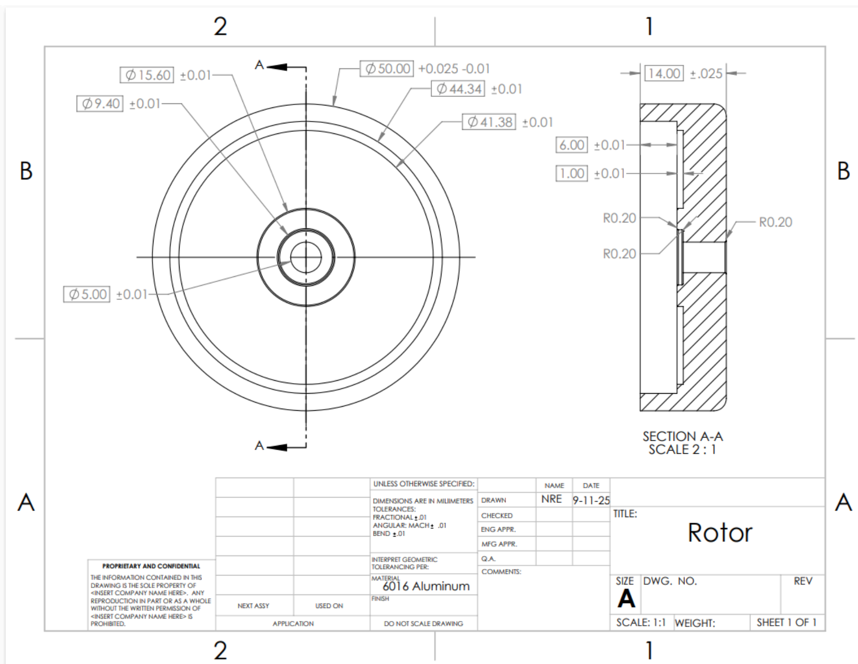

Figure 4: Drawing of Rotor

Within the drawing it is observed that the overall outer diameter of the rotor has a tolerance of $\pm$ .025 mm, this is because that dimension is not being mated with any other moving parts. On the contrary all of the dimensions within the inner diameter of the rotor have tolerances of $\pm$.01 mm because they are being mated with other parts. The .01 mm tolerances was decided upon because error within machining is expected. This tolerance accounts for those uncertainties while ensuring that the other parts will fit correctly. The shaft shown in Figure 5 below was toleranced in a very similar way to the rotor. All fits that interact with other parts are to be machined within

.01 mm and the components that do not interact with other parts are to be machined with .025 mm.

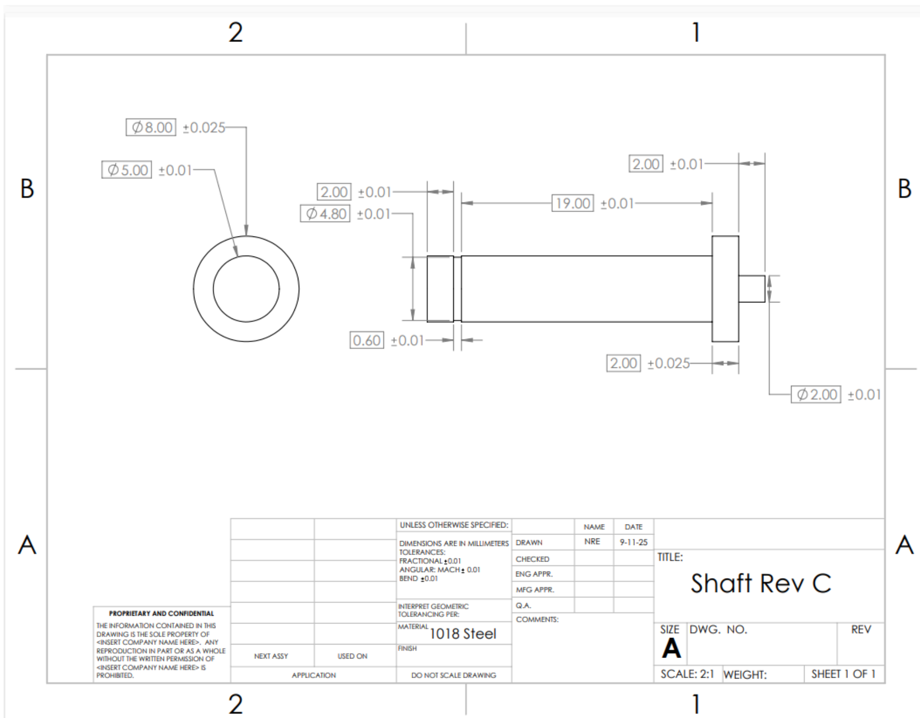

Figure 5: Drawing of Shaft

Conclusion

Learning more about tolerances and different types of fits will continue to be very beneficial. This will allow my capstone team to be able to make a product with many different moving components to work seamlessly. I will be continuing to learn more about different fits and tolerances as it will be a very crucial skill to have in industry.

Sources

[1] Basics of tolerance stack-up analysis and fits with GD&T | Udemy, https://www.udemy.com/course/basics-of-tolerance-analyses-stackup-and-fits/ (accessed Sep. 13, 2025).