8995T's Final Summary Report: Custom Angular Gear

For this event, my team, 8995T, created a custom angular gear. We developed our idea while designing and building our x-drive. While designing the x-drive, we ran into the problem of the vex ball, hitting the two front motors. Our initial method to solve the issue was to use a series of gear ratios to move the motor back into the frame of the body. However, this method was flawed due to the wheels being at a 45-degree angle. Then it came to us: what if we created a type of gear the angle of the teeth could be customized?

The custom angular gear's main feature is that the gear's teeth can pivot 0-90 degrees. This feature adds value as bevel gears are extremely rigid when incorporated into a gear system. This is the best of both worlds, having a more flexible gear that allows any angle for gear systems. One way this part can be used in a robot is building an x-drive. We can put the angular gear in the middle of two gears that connect a gear to the angled wheel. Our parts' applications are incredibly diverse, ranging from a standard strength gear to creating a mechanic with gear stripping. This gear allows a 0-degree angle, which can just be used as standard linear gears. You can also use the gear as an angle, which can offer fewer limits on what gears can do. Another application for this gear is that instead of trying to strip a gear, you can take out the teeth and add extra teeth if one does break. Many times the teeth die due to the stress and using our gear, there are inserts to add extra teeth. Sometimes the opposite is needed, where we strip the teeth to create something new. For example, two years ago, we stripped a gear to create a linear punch. We stripped the gear and added rubber bands, so when the gear gets to the stripped part, it slips and offers energy for the punch. The main issue was that gear was thrown away, but when using the custom gear, you can take teeth out. There are many other applications, but these were the best and common usages of our custom gear.

Our team started this event with an understanding of the limitations of the different robotic parts. We decided to create a list of limitations, which included gears not working on different angles, positioning metal parts at specific angles, and the fewer V5 motors available. After that, we strived to create solutions for each of our limitations. We drew designs and then created a decision matrix to decide which method would best improve our limitations. With the help of the decision matrix, we were on the hunt for a piece that was simple, user-friendly, and efficient. We rated each part on a scale of 10 and concluded that the custom angular gear was the best option available. After deciding on the part, the next step was to make different custom angular gear designs. We went through various iterations of the custom gear until we streamlined it to look like the model today. After that, we designed the gear in AutoDesk Fusion 360, version 2.0.9313.

We started with the gear body, striving to ensure the body was identical to the standard 36 tooth gear. We created the sketches and extruded them to size. We added the axle hole and then extruded the main body, and we had finally finished the main body. Before we could create the rest of the gear, we had to create an insert where the bevel would go, so we created a circle and revolved around, leaving a circular insert. Our first method was to combine the bevels and teeth, so the bevel was spinning. As we further got into creating the bevels, we realized the bevels would not move with our design. We decided to make the teeth pivot inside the inserts on the bevel. We created the bevels with inserts every 10 degrees to have 36 teeth inserts. Then we began the teeth, making sure they were the vex standard size, and meticulously put them inside the insert. After finishing the gear and teeth, we wanted the teeth to move in their inserts. We decided to add joints to each tooth, allowing them to rotate 0-90 degrees in the insert. To offer some visual representation, we created two different angle configurations with standard 36 tooth gears to show our part working.

In conclusion, our team learned a significant amount of information from this event. Looking at the technical side, we learned how to sketch objects, build bodies and components, create animations, render parts, building joints, use the planer and axel features, and most of the modifications options available. We hope to use these skills in the future for robot designing. 8995T feels that the usage and incorporation of CAD have much value to add to robotic teams. We can use these programs to help us simulate the robot and fix flaws to create robots with skill and precision never seen before.