VEX IQ Challenge "Make It Real" CAD Engineering Challenge Sponsored by Autodesk®

Planetary Ring Gear with Outer Teeth

By

Team 839A

James Ding

Vincent Jiang

Tyler Lee

Briallyn Quast

I am team 839A's Fusion designer. While we were looking at x-drives, our builder, Tyler, noticed that everybody using it was struggling with accuracy in autonomous. This was because of the omnis, and Tyler then told us about a robot with 4 wheel traction drive from other robotics competitions, often called a swerve or crab drive. Normally, swerve drives have 8 motors but we can only use 6 because Tyler came up with the idea of having one motor in the middle that spins all of the other wheel modules. Tyler built our first swerve module but discovered the motor cables would twist as each module turned. The robot could only turn so much then had to turn back to unwind all of the cables. Tyler thought about how much better it would be to do infinite turns, but this would only work if we had a piece that doesn't exist in VEX IQ.

To get an idea of this concept we looked at the "planetary gearbox-ring gear" module, which shows an "orbit" gear with teeth on the outside and a motor attached. Luckily, we have a lot of the kits made by VEX and hexbug, in which we found the actual ring gear made by vex, which has teeth on the inside, but none on the outside. Tyler thought that it would be best if the gear had teeth on the outside. This is so that the drivetrain motor for the swerve module can be attached on the top plate so it's not moving and the motor wires do not twist.

We also want to use this new custom part in the middle with 16 tooth gears inside of it. This is so we can gear down to increase torque and connect to the 4 swerve modules using sprockets and chains. It is much harder to gear down in the middle because we wanted to use 1 to 5 gearing and because you needed a big one in each direction, the big ones would mesh, making it impossible to spin the modules that way. This allowed us to control the steering with just 1 motor. So we discussed the idea, and I got to work on Fusion 360 version F360_v_2.0.8407.

I made this piece by first using a planetary ring gear and a 60 tooth gear and tried to use a sketch to delete the ring gear's outer and inner lip. I then tried to use a sketch to delete the inside part of the 60 tooth gear, but there was a problem it wouldn't delete. So I then tried to use holes on the gear and it still didn't work. I tried many things including using a sketch to try to extrude out the middle and using the hole function to just try to cut it out entirely. That's when I realized that you have to break the link between all of the pieces of the gear so that you can change it and delete and keep only what you want. I then finished and put everything together, but a new problem came up. There were tiny holes and spaces between the ring gear and the outside of the 60 tooth gear. So I decided to do it again, but this time I didn't delete the inside lip of the 60 tooth gear and it was finally perfect.

When the 3D printing finished, we planned on printing a few more, the first one was just a sample to see how it would turn out. When we tried it out, it worked. I remember the first time I started learning Fusion my hands would freeze up, because I was really worried and at the same time very excited because I never did Fusion or anything like it until our club's summer courses. Before I did all this Fusion I loved to build and fix things, like lego and others that are similar to VEX. So when I first learned Fusion, I had a lot of problems, like when I jointed the wrong part of the piece and caused it to malfunction and when it could not rotate and there were errors and warnings. I started to do a whole bunch of experiments to see what would work. Everytime I finished a class I would do more CAD on it to remember what I learned even if my computer took very long to respond. I would make a lot of projects on Fusion and I made a lot of interesting things. I made a hoverboard, skateboard, ripstick and more. Any time I had to spare, I would make more claws and H-drives. Fusion 360 might help with my future because if I were to think up new things and ideas, I could use Fusion as brainstorming. For example,

inventing something new for future generations of our robot. I might build many more, and better, machines. Because of this project, I learned that when you put everyone's different skills and minds together we can make the impossible happen. You can create anything and everything if you want. Fusion can help our careers stem because whenever I want to make something physical I can use CAD to see it and show everyone. I plan on taking next year's club course on Fusion which teaches drawing files and circuits, which will make me more prepared for future careers.