Shock Absorber for MK4 Swerve Drive Module

VEXU- “Make it Real” CAD Engineering Online Challenge by Autodesk

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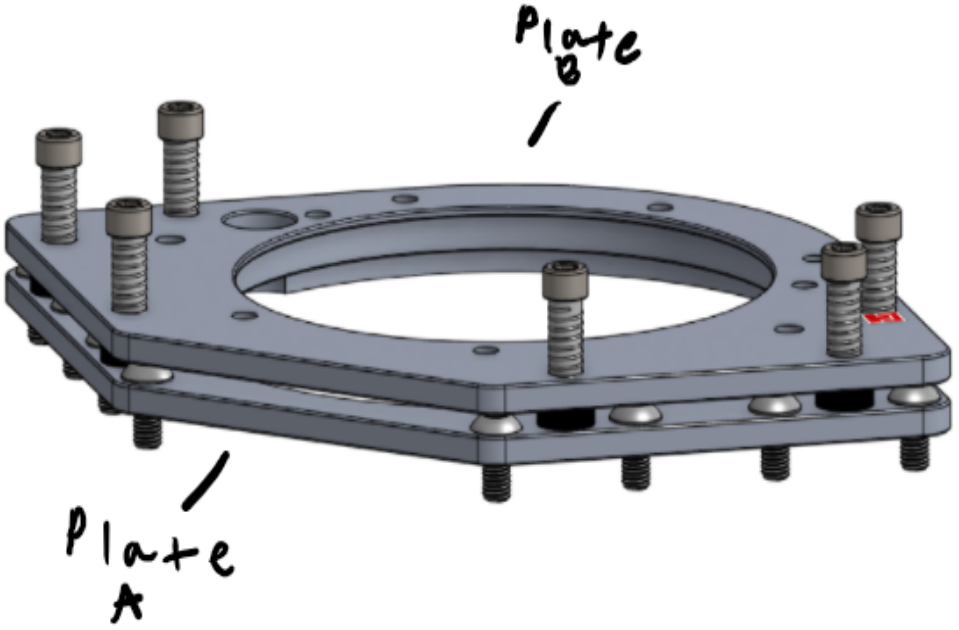
One of the most expensive parts on a FRC robot is the swerve module. In order to protect the investment in the robot, I designed a shock absorber for an FRC swerve module using AutoDesk Fusion 360. I used the sketch and extruder features to design, modify and implement my design to show the functionality on the swerve module. This particular CAD is for a West Coast drive MK4 swerve module, but can be easily modified for any other swerve modules. The prototype shock absorber would help to solve a large problem faced by many FRC teams with swerve drive drivetrains, which has low tolerance for bumps, jarring and ledges that can often lead to malfunction of the swerve drive. The swerve module is arguably one of the most essential parts in the functionality of a robot in that it is the motorized caster that helps to move the robot.

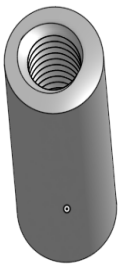
This shock absorber is not designed to keep the robot completely stable while going over bumps or being jarred, but rather to just smooth the transition for the robot. It is also designed to ensure that when the robot rolls over a barrier, like the 1” x 2” bars in last season's FRC game, more smoothly. With this design, the wheels and structural components of the robot take the brunt of the bump, and not the mechanisms and components in the swerve module. The bi-plate design is necessary so plate A is designed to be permanently attached to the frame of the robot. While plate B is designed to move with the swerve module to keep all of the mechanisms aligned, and functioning properly through the use of springs, threaded bushings, rubber stoppers and 10/32 bolts.



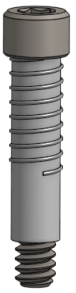
My design uses six one inch long 10/32 bolts, 2 modified swerve drive plates, 6 rubber stoppers, 6 threaded bushings and 6 springs. The 6 one inch long bolts allow the top plate to be fastened to the bottom plate without attaching to the frame of the robot, which will allow the plate the swerve drive is attached to, to move

independently from the frame. The rubber stoppers are placed in between the two plates to allow a protective barrier to prevent them from banging together when the robot is faced with drastic changes in terrain or major shifts in the robot. Along with the bolts, which go through Plate B, thread into the bushing and go through the rubber stopper, these bolts thread directly into Plate A. The threaded bushings are implemented to act as a linear guide for the spring that is placed over the threaded bushing to absorb the shock for the swerve module. The threaded bushings help to insure that the spring moves up and and down every time and would not leave much room for a horizontal shift in the spring.

Threaded Bushing

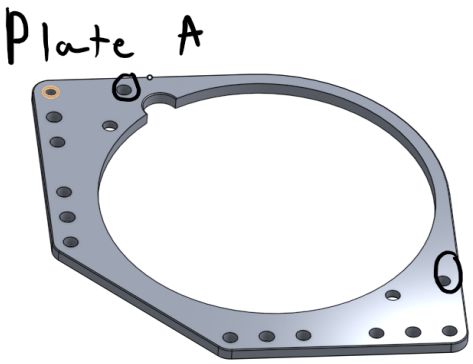


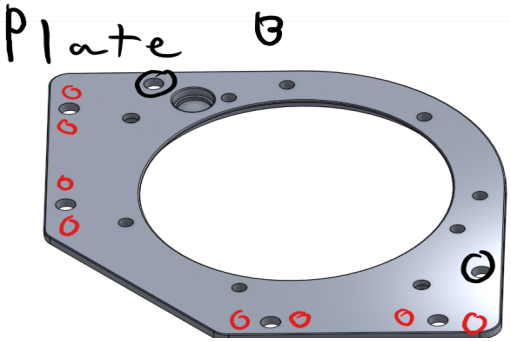
Completed linear Guide



As mentioned previously, the most unique feature of this shock absorber is the two plate design. Plate A is a standard MK4 plate with a larger inner hole to allow every part of the swerve module to rotate inside it, and it has two extra holes to allow for the 1st and 6th linear guides. These two holes are circled in the diagram as they are easy to miss, but an important part of the design, as the linear guides that go here ensure that the whole module is properly supported and secured. In total on Plate A, there are 6 holes that line up with Plate B to attach the 6 10/32 bolts, 6 threaded bushings, 6 springs and 6 rubber stoppers, respectively to Plate A.

Plate B also has some changes made. It has the same two holes added as plate A for the reason mentioned above but it also has the outside holes of each section of three removed. The added holes are circled in black, and the removed holes are circled in red. Using the same plate design of the original swerve drive, Plate B has 8 of the original holes removed as they are no longer needed due to the fixation of Plate A through the shock absorber prototype. Plate A is then fixed to the frame of the robot with 8 10/32 bolts and is independent of the attachment of the shock absorber, which again will allow the swerve drive to actuate independent from the frame of the robot and help protect the components and function of the swerve module.





Please note, I did not include a direct picture of the spring, rubber stopper or bolt as they are standard pieces that do not need any modifications, unlike the plates. I included a picture of the threaded bushing and bolts to show how they would interact with each other.

In conclusion, I was previously versed in OnShape CAD software and design. This challenge opened up a new platform for me to utilize when CADing. I used the Autodesk Fusion 360 sketch and extruder features to design my part. I chose this design because it was very simple, would be easy to manufacture, assemble and replace while being economical for teams. My goal was to prioritize simplicity, functionality and a low-cost design without modifying the brilliance and functionality of the swerve drive. Many teams utilize these modules and face the same challenges of the fluctuation in function due to field obstacles, jarring and bumps. This shock absorber for the swerve module would allow for a simple and economical addition to help protect the intricate and delicate components within the swerve module. Additionally, the shock absorber will help preserve the integrity of the module and increase the precision and functionality of the unit, ultimately giving any robot that utilizes this addition an advantage over their competition.