7 - Gussets & Brackets

Sometimes fasteners alone are not enough to hold pieces together. In these cases, you can use extra pieces such as gussets or brackets to join the other pieces.

7.1 - Gussets

Gussets are flat pieces that join parts via several rivets. They are most often used to connect rectangular tubes to each other, and they only work in places where surfaces of the tubes line up. They are typically easy to manufacture using the CNC router.

Designing a gusset is like designing any other flat piece. You just need to make holes for the rivets in a standard pattern, such that the holes fall on the center of the tube if possible. In the assembly, remember to design for match drilling, as typically only the gusset, not the tube, will have holes.

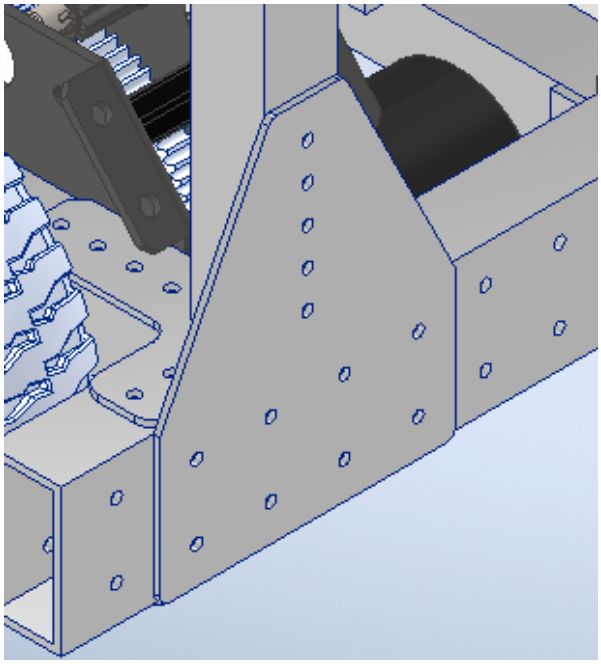

Figure 1: A custom gusset on the 2020 robot, connecting two frame pieces together. Note how the rivet holes are centered on the vertical tube, and a simple hole pattern is used on the horizontal tube.

7.2 - Brackets

Brackets are pieces made from angle stock that join other pieces together. They use fasteners, typically rivets but sometimes bolts, that pass through the sides of the angle stock. They are best used wherever the faces of the tubes are not accessible, where gussets would not work.

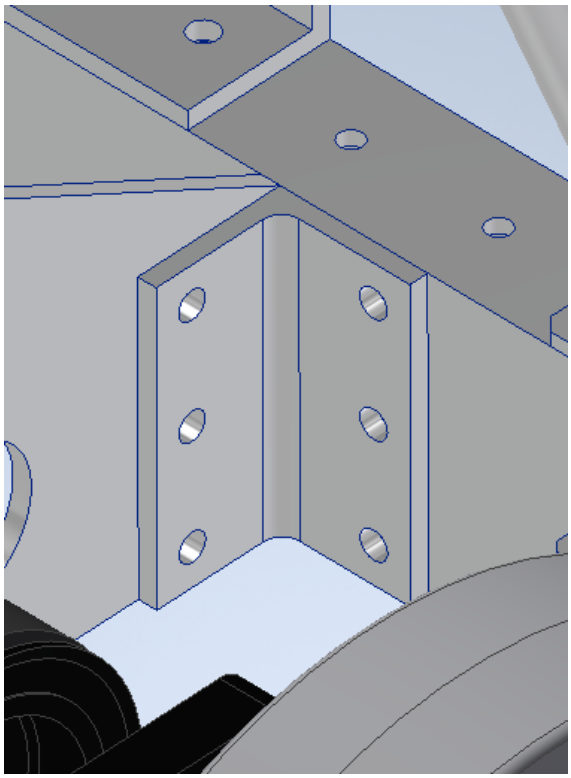

Figure 2: A bracket on the 2018 robot used to join a flat plate to a tube.

7.3 - VersaFrame Gussets

Although gussets are not terribly difficult to manufacture, it is even easier to purchase COTS gussets. The best supplier for these is VexPro, whose extensive VersaFrame product line features many types of gussets designed to join 1" square tubes together. Because these require no manufacturing time, as with any COTS parts, it is best to use them wherever possible.

They all use 5/32" rivets spaced 0.5" apart, and they are made of 0.09"-thick aluminum sheet. They come primarily in T shapes and standard angles such as 30°, 45°, and 90°. VexPro also sells one angle bracket which is made out of bent sheet metal.

VersaFrame T Gusset

VersaFrame 60° Gusset

VersaFrame Corner Gusset (Bracket)

Figure 3: Various VersaFrame gussets
(Images from VexPro.com)

Design Challenge 7: Frame Design with Gussets

Find the assembly "DC7_ASM.iam" in File Explorer, and copy it to your own directory. This is an incomplete hypothetical frame assembly that has all the necessary frame members but no gussets, brackets, or fasteners. The long 2" x 1" tubes have holes in them already because they are VersaFrame tubes.

Your task is to complete the assembly by designing the appropriate gusset and bracket parts. Use either rivets or bolts, whichever you think is better for the application. Also, use at least one custom gusset, one custom angle bracket, and one VersaFrame gusset. (Of course, you'll need more than just these three.) Finally, use parts multiple times as much as possible, and remember to account for match drilling in your design.