Assignment 1 - Grasp Planning

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For the grasp planning assignment, I display two figures. One is of the polygon with the friction cone and the other of the force closure showing that it contains origin and a circle showing the shortest distance from the origin.

The polygon can be inputed clockwise or anticlockwise. I just change the direction when plotting which seems to be giving the correct output.

I am using the below algorithm.

Iterating over all possible combinations of sides i.e NC2 combinations if N is number of sides.
For every combination:

1. Finding the unit vector in the direction of the sides
2. Rotating it by angle 270-alpha and 270+alpha about the midpoint of the lines and that gives the end points of the friction cone, the output is a vector about the midpoint and the assumption is that the torque is zero
3. The friction cone points are plotted on the x and y axis with origin as the start point and the values of those friction cones as vectors
4. Convex hull is then created for the friction cone points about the origin
5. Test if the origin lies inside the convex hull
6. If origin lies is inside the convex hull, the force closure is stable and if not then it is not a stable grasp
7. To check the optimality, Choose the option such that the closest point to the origin is farthest among all options possible i.e. the convex hull that is created, its closest point from the origin is the farthest among all possible combinations of convex hulls
8. Finally, plotting the friction cone on the polygon and the other figure shows the force closure with a circle that shows

Optimality criteria as explained above was chosen to be the farthest side of the convex hull from the origin of all possible combinations of stable grasps.