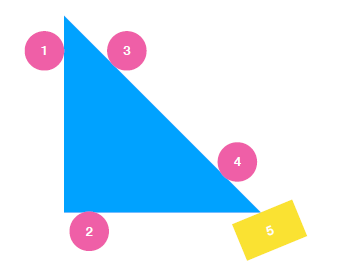
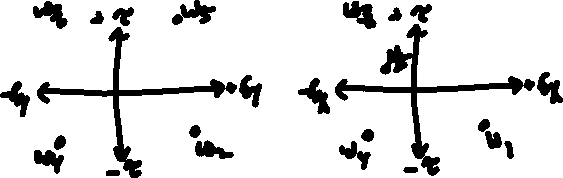
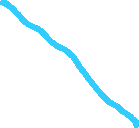
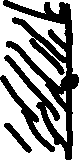
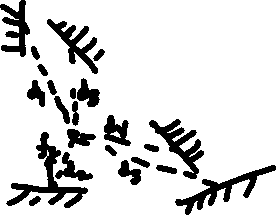
Problem 1

1. Since a force closure is evaluated with both normal and friction forces, if you have a form closure which is evaluated with only normal forces, the addition of friction forces would only enhance the robustness of the grasp, therefore force closure is also achieved. If the forces at the contact points were limited, the addition of friction would decrease the normal force necessary to secure the grasp from the same disturbance.
2. In 2D (assume x-y plane), you have 3 DoF, so 2 contacts are required to restrain positive and negative movement in the x-direction and 2 contacts are required to restrain positive and negative movement in the y-direction
3. 



Point 1 is always required because it is the only contact force applied in the positive x direction, while Points 3, 4, and 5 apply forces in the negative x direction. Points 1, 2, and 4 apply positive torque and Points 3 and 5 apply negative torque, so one of each is always required to balance any external torque. Points 2 and 5 apply in the positive y and Points 3 and 4 apply in the negative y. Since all, but the positive x-direction are redundant, we can see that the following are valid subsets of 4 points:

1, 2, 3, 5 1, 2, 4, 5 1, 2, 3, 4 1, 3, 4, 5

1. das

Problem 2

1. Contact Forces and Grasp Map
2. Reformulated SOCP