Overview

My main plan is to do MPC wrapped around iLQR (or an alternative controller) to control the Yale Stewart Hand and do manipulation of a point on an object grasped by the hand by drawing a square. The stewart hand's base joints, which connect the fingers to the hand's base are underactuated, and are driven by a single actuator connected through a differential to the fingers to control the in and out actuation. Each of the finger tips is connected to 2 linear actuators which form a triangle which controls the fingertip position. So, the system has 7 actuators which are used to control the system. I'll leave the base joints actuated by the differential, but not actively control the motor. I'll control the system using the 6 linear actuators alone. I'll then model the system, linearize it using information about the current actuaor positions, and control it via iLQR wrapped around MPC. I have 2 concerns about my approach, 1 is that I won't be able to get iLQR working for the manipulation system due to the complex dynamics and 2 that the underactuation of the system. I'm not too worried about iLQR struggling to control the hand, as MPC has worked well for underactuated hands in the past, so I think the I'll be able to control the hand. If the underactuation of the system causes problems with control, I'll make all the base joints fully actuated and include them in the controller. This will enable full control of the system.