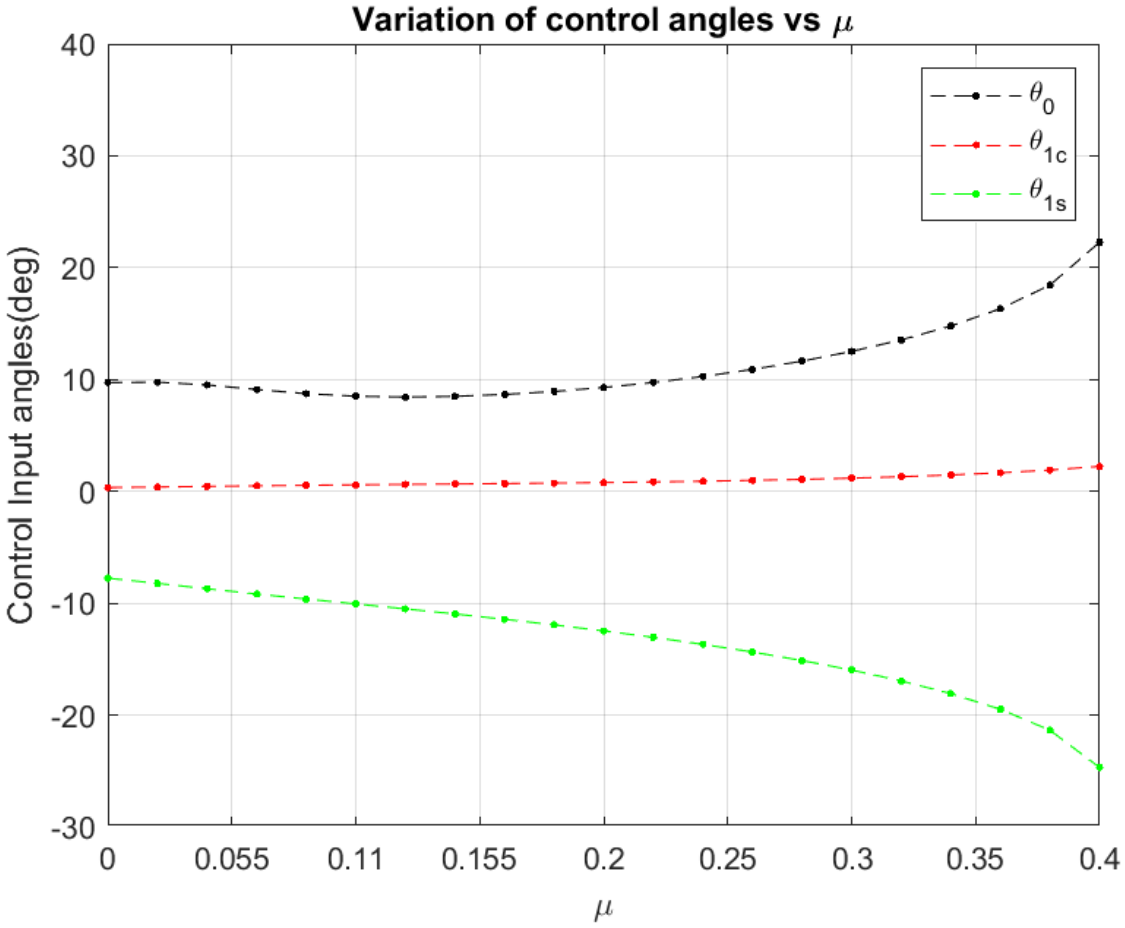
Helicopter Theory

---------- A Coupled Trim Solution For the Helicopter ----------

Following analysis is done for varying μ (0 to 0.45) and the coupled trim solution shows following output:

Figure 1:
Plotting the variation of control angles w.r.t μ.



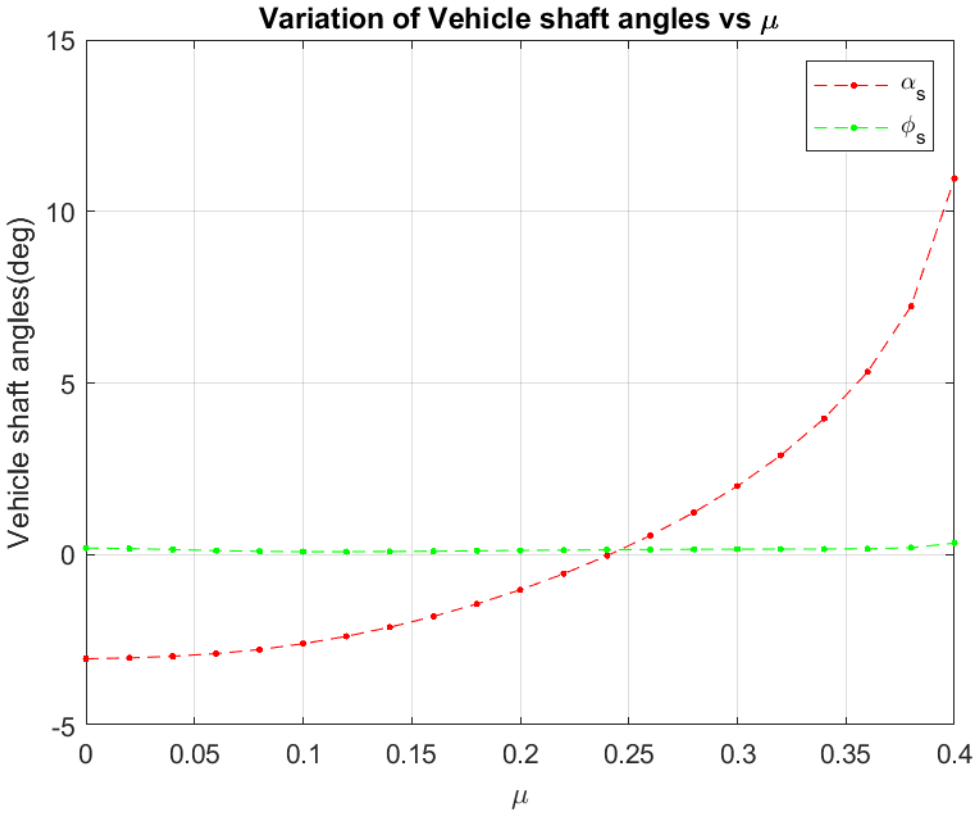
Comment:

- As we can see in Figure 1, the variation of control input angles w.r.t increasing non-dimensional forward velocity, as we can see from plot of θ_0 for collective pitch which shows the constant response upto 0.25 non-dimensional forward velocity, which means

helicopter don’ t need to change the collective pitch till 0.25 mu. But after this point the collective pitch is increasing with forward velocity. This is because the rotor RPM is fixed so pilot has to increase the collective pitch to increase the forward velocity.

- Here, θ_{1s} and θ_{1c} is cyclic pitch is mostly responsible to stabilize the helicopter in the direction of travel, here forward.

Figure 2:
Plotting the variation of Vehicle shaft angles w.r.t μ



Comment:

- As we can see in Figure 2, there is constant variation in lateral direction as we are not giving any condition for side ward motion, so helicopter has trim to some lateral shaft tilt.
- There is continuous increase in longitudinal shaft tilt for increasing forward velocity,
- From Figure 1 & Figure 2 we see that continuously increasing forward shaft tilt using cyclic pitch control for increasing the forward velocity of a helicopter while maintaining stability and control.