ASEN 3128 Assignment 3

Due: Thursday, September 26 at 23:59 on Canvas

1) Develop a **linearized** model of the full Quadcopter dynamics in body frame coordinates about a steady hover trim state.
2) Simulate the response of the **non-linear** Quadcopter system to initial condition deviations from the steady hover trim state as follows:
    a. Deviation by +5 deg in bank
    b. Deviation by +5 deg in pitch
    c. Deviation by +5 deg in azimuth
    d. Deviation by +0.1 rad/sec in roll rate
    e. Deviation by +0.1 rad/sec in pitch rate
    f. Deviation by +0.1 rad/sec in yaw rate

    Discuss the resulting behavior. Does it make physical sense? Is the steady hover a stable flight condition?
3) Repeat 2) using the **linearized** dynamics model, and compare linearized and non-linearized behaviors.
4) Add a feedback control in your non-linear simulation such that the control moments about each body axis are proportional to the rotational rates about their respective axes, but in opposition to the sign of angular velocity with a gain of 0.004 Nm/(rad/sec), and repeat parts 2) d. through 2) f. What is the effect of this control law?
5) Implement this control law on the Rolling Spider quad copter, where the copter is launched into a steady hover and the control law is then turned off, as before, but now with your angular rate feedback control in place. Compare the behavior to the case from Assignment 2 where no control is acting. What is the effect of this control law?