AE 450 Homework #2

Due on Nov. 9, 2018

Your task is to design longitudinal controller for an aircraft. The dynamics model can be found from any textbook or web-site. There are plenty of it.

Part 1. Please find out any linearized model of longitudinal motion of an aircraft from any textbook or web-site. The system dynamics shall be given in the form. Please refer to lecture note for details.

$$\dot{\mathbf{x}} = A\mathbf{x} + B\mathbf{u}$$

where $\mathbf{x} = [u, w, q, \theta]^{\mathrm{T}}$.

Part 2. Find out natural frequencies and damping ratio from the given system matrix(A) in **Part 1**.

Part 3. Construct short period approximate model and phugoid approximate model from **Part 1**. Compare natural frequencies and damping ratio from Par 1.

Part 4. Set up a target short period closed-loop system dynamics in terms of natural frequency and damping ratio.

Part 5. Design a feedback control law either in pitch angle feedback or pitch angle plus pitch rate feedback to meet the requirements of the closed-loop systems. You can use either Root-locus or pole placement technique in the similar way to the lecture note.

Part 6. Compare closed-loop time responses to initial conditions for the open-loop(**Part 1**) and closed-loop system by feedback control. You can plot the time responses of state variables for comparison.

Part 7. Propose a phase-lead compensator design. Do your best to fix the parameters of the compensator to meet the same close-loop system dynamics. Demonstrate the benefit of using compensator compared to other approaches in **Part 5** with your best effort.

Note : Original computer code should be submitted together with results.