Aircraft Dynamics 833 April 2015

Introductory course to aircraft dynamics

Homework 3

Design of Aircraft Longitudinal Controllers

Design the following longitudinal controllers for the aircraft described in Appendix A.

- Pitch Rate Damper
- Airspeed and Climb Rate Controller
- Altitude Controller

Select your own specifications for each controller, but keep the physical limitations of the actuators in mind. The elevator deflection should not exceed about 10 degrees, and the maximum throttle is 70 N. The controllers should therefore not be unnecessarily aggressive. (Also refer to Dr Peddle's master's thesis for guidelines on choosing appropriate specifications for each controller.)

For each controller, implement the control law on the linearised, decoupled longitudinal model and obtain the step response to verify that the design meets your specifications.

Implement your longitudinal controllers on the nonlinear simulation model of Homework 1. Successively close the control loops and verify that each controller meets your design specifications. Your tests should include:

- Airspeed steps and climb rate steps to test the Airspeed and Climb Rate Controller
- Altitude steps to test the Altitude Controller

Connect the nonlinear simulation to the QTGLEngine software to visualise the flight control with 3D computer graphics.