Aircraft Dynamics 833 April 2015

Introductory course to aircraft dynamics

Homework 4

Design of Aircraft Lateral Controllers

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

- Dutch Roll Damper
- Roll Angle Controller
- Heading Controller

Select your own specifications for each controller, but keep the physical limitations of the actuators in mind. Neither the aileron deflection nor the rudder deflection should exceed about 10 degrees. 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 lateral model and obtain the step response to verify that the design meets your specifications.

Full Flight Control

Implement your longitudinal and lateral 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
- Roll angle steps to test the Roll Angle Controller
- Heading steps to test the Heading Controller

Once all the controllers have been implemented, make sure that you can command the aircraft to fly at a target airspeed, altitude and heading.

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