

EE 380 DESIGN PROBLEM DEFINITION

Due 31/12/2008

The attitude of an aircraft is controlled by three sets of surfaces: elevators, rudder, and ailerons as shown in Figure 1. By manipulating these surfaces, a pilot can set the aircraft on a desired flight path. An autopilot, which will be considered here, is an automatic control system that controls the roll angle Φ by adjusting aileron surfaces. The deflection of the aileron surfaces by an angle θ generates a torque due to air pressure on these surfaces. This causes a rolling motion of the aircraft. The aileron surfaces are controlled by a hydraulic actuator with a transfer function $1/s$. A simplified block diagram for automatic control of an airplane is shown in Figure 2. Assume that $K_1=1$ and that the roll rate $\dot{\Phi}$ is fed back using a rate gyro (of gain K_2). The desired step response has an overshoot less than 10% and a settling time (2% criterion) less than 9 seconds.

Using MATLAB select parameters K_a (Amplifier gain) and K_2 to meet the desired overshoot and settling time

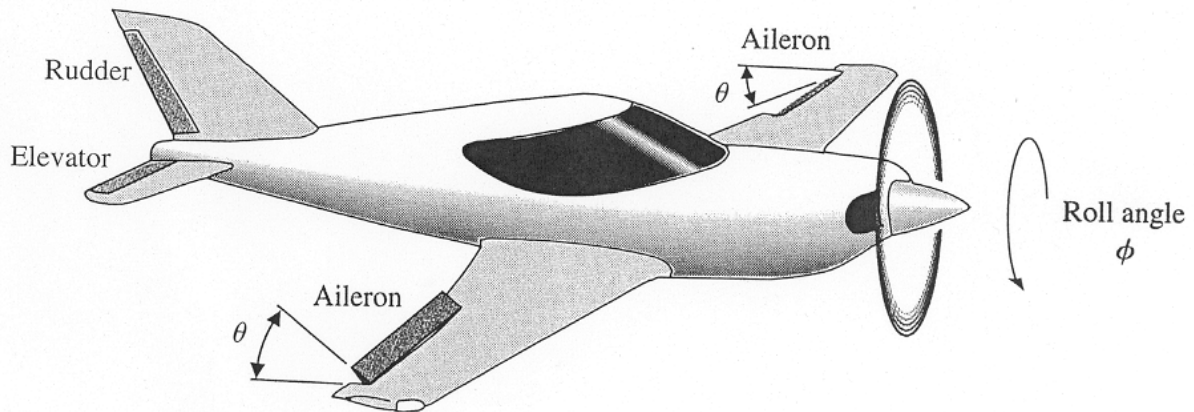


Figure 1

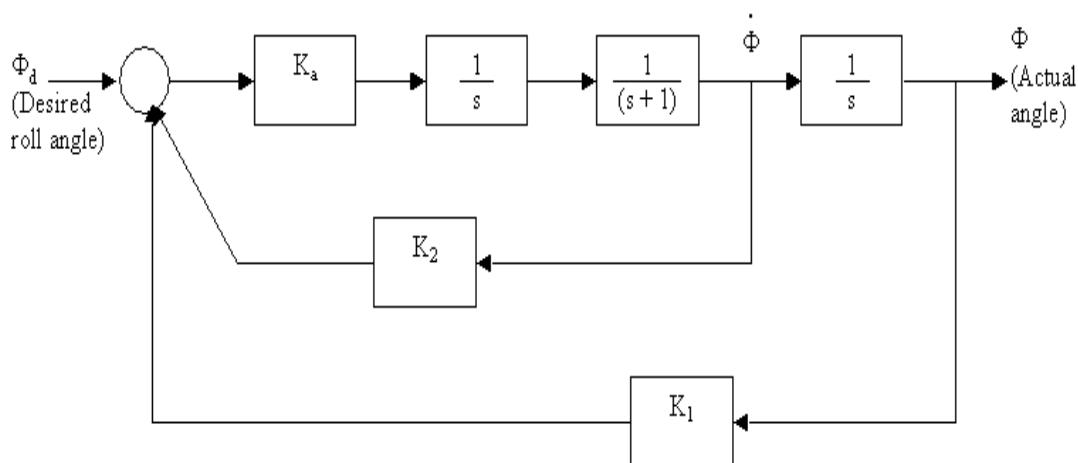


Figure 2