Helicopter Control System Design Problem
AERO 422:Project

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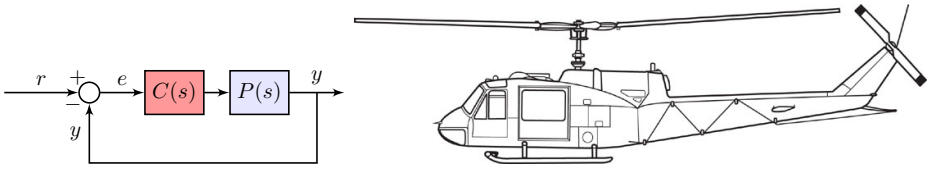
Helicopter Pitch Control

You are to design a pitch control auto pilot for a helicopter model. The following block diagram defines the control problem.



(a) Proposed control system (b) Helicopter schematic

Figure 1: Helicopter control system

Figure 1(a) illustrates the proposed control system. Pitch control of the vehicle in fig.1(b) is performed by tilting the main rotor, thus $u(t)$ is the tilt angle of the main rotor. The output is the pitch angle $y(t) := \theta(t)$. The pilot commands a desired pitch angle and the control system $C(s)$ is expected to track this command satisfactorily. The model for the helicopter is

$$P(s) = \frac{3042}{s^6 + 0.846s^5 + 2542s^4 + 1873s^3 + 1.059 \times 10^5 s^2 + 1.023 \times 10^4 s + 6084}.$$

You are to design a controller to achieve good reference tracking performance, without much oscillations. Acceptable overshoot is 10%, with rise time less than 1.0 seconds, and a settling time of 5 seconds. Choose lead/lag or PID design framework.