

06.12 rldesign.exe Exercises for Chapter 06 rldesign

Exercise 06.6 quixotism

Given the design methods we've learned, comment on how the *transient* response of a system with P-control differs with the inclusion of integral compensation.

Exercise 06.7 arval

How do P-, PI-, PD-, and PID-control affect a system's performance. (Limit your response to one sentence per controller.)

Exercise 06.8 22

Let a system have plant transfer function

$$\frac{10(s + 20)}{(s + 10)(s + 4)(s + 1)}. \quad (1)$$

Design a PD controller such that the closed-loop rise time is about 0.2 seconds and the overshoot is just under 25%.

Exercise 06.9 23

Let a system have plant transfer function

$$\frac{1}{s^3 + 22s^2 + 156s + 232}. \quad (2)$$

Design a PID controller such that the closed-loop settling time is less than 0.5 seconds, the overshoot is less than 10%, and the steady-state error is zero for a step command.

Exercise 06.10 diurnation

Let a control system have the block diagram in Fig. exe.1, unity feedback $H(s) = 1$, and plant transfer function

$$G(s) = \frac{160}{s(s^2 + 16s + 160)}. \quad (3)$$

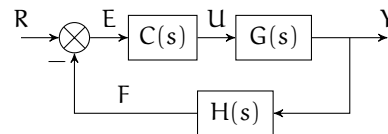


Figure exe.1: a block diagram with a controller $C(s)$.

1. Design a PID controller $C(s)$ such that the closed-loop overshoot is less than 30%, peak time is close to 0.25 seconds, and the steady-state error is zero for a ramp command.
2. Demonstrate the controller performance by simulating and plotting both a step response and a ramp response.
3. Compute the simulated overshoot and peak time (via the step response).

Frequency response analysis