08.2 freqd.exe Exercises for Chapter 08 freqd

Exercise 08.1 libricide

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

$$G(s) = \frac{1}{s^3 + 11s^2 + 39s + 29}. \tag{1}$$

1. Use frequency response methods to design a gain controller such that the unity feedback closed-loop overshoot is about 10%.
2. Demonstrate the controller performance by simulating and plotting a step response.
3. Compute the simulated overshoot (via the step response).

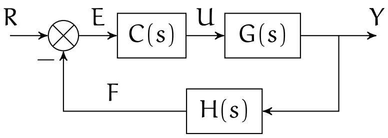

Figure exe.1: a block diagram with a controller $C(s)$.

09 ss

State-space design

Root-locus and frequency-domain design techniques have their own strengths, but they cannot be applied to broad classes of systems, including nonlinear systems and multiple-input multiple-output (MIMO) systems. Moreover, these techniques can only attempt to specify the locations of the dominant closed-loop poles. Therefore, those systems for which higher-order poles significantly affect the response do not respond well to these techniques.

These are some of the reasons why "modern" control theory uses state-space design techniques. Drawbacks of these techniques are limited, but include that less insight can be gained from them and that closed-loop zeros cannot be specified directly.

For an n-th order plant, n poles must be placed. This requires n adjustable parameters, which are gains. We will learn a technique in this chapter for placing these n poles with n gains for a certain class of systems.