

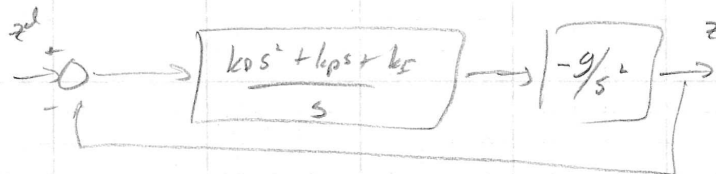
Homework E.14 - Solution

Soln

①

E.14

The outer loop with integrator is



The char eq is

$$1 + P(s)C(s) = 1 + \left(\frac{-g}{s^2} \right) \left(\frac{k_0 s^2 + k_p s + k_I}{s} \right) = 0$$

$$\Rightarrow s^3 + (-g k_0) s^2 + (-g k_p) s + (-g k_I) = 0$$

$$\Rightarrow 1 + k_I \left(\frac{-g}{s^3 + (-g k_0) s^2 + (-g k_p) s} \right) = 0$$

Matlab command for root locus is

$$rlocus([-g], [1, -g k_0, -g k_p, 0])$$