Tutorial – 1-01-j

Q1 Ex 14-6 (dominant pole)

By using the dorminant root approach, find the step response of the following system, based on a reduced order (1st order) model:

(a) $$\frac{C}{R} = \frac{5}{(s+1)(s+5)}$$

(b) $$\frac{C}{R} = \frac{5.5(s+0.91)}{(s+1)(s+5)}$$

Q2 Ex 14-10 (Point Design)

Design a phase compensator G_1, so that for the plant G_2:

$$G_2 = \frac{K}{s(s+2)^2}$$

The closed-loop response must have a 10 to 90% rise time less than 1 sec, and an overshoot less than 20%.

Q3 14-1, 14-2 (Gain Factor Compensation)

(a)

Determine the value of the gain factor K for which the system with the open-loop transfer function

$$GH = \frac{K}{s(s+2)(s+4)}$$

has closed-loop poles with a damping ratio $\zeta = 0.5$.

(b)

Determine a value of K for which the system with the open-loop transfer function

$$GH = \frac{K}{(s+2)^2(s+3)}$$

satisfies the following specifications: (a) $K_p \geq 2$, (b) gain margin ≥ 3.