1. For each feedback system shown below, find the transfer function of the whole system, with feedback.

Find \( H(s) = \frac{X_{out}(s)}{X_{in}(s)} \) For each

Simplify your expression for \( H(s) \) so that the numerator and denominator are both simple polynomials

a) \[ \frac{30}{s+8} \]

b) \[ \frac{K}{s+10} \]

c) Find the value of \( K \) to make the transfer function critically damped.

d) If \( K \) is more than this value the system will be: underdamped or overdamped

e) Does the transfer function have a zero? If yes, what is it?

f) \[ \frac{G}{s+30} \]

g) Find the value of \( G \) to make the transfer function critically damped.

h) If \( G \) is less than this value the system will be: underdamped or overdamped

i) Does the transfer function have a zero? If yes, what is it?

2. Problem 3.2b, p.50 in Bodson text

3. Problem 3.3, p.50 in Bodson text As part of your work to reach a solution, draw the pole diagram for each.

Answers

1. a) \[ \frac{30-s+1800}{s^2+68s+510} \] b) \[ \frac{K(24s(s+30)}{s^2+40s+300+2K} \] c) 50 d) underdamped e) 0,-30

f) \[ \frac{G-80s+G-4800}{s^2+90s+800G+1800} \] g) 0.28125

h) overdamped i) -60

2. \[ \frac{H_1H_4 + H_2H_4 - H_1H_2H_3 + H_1H_3}{1+H_1} \]

ECE 3510 homework # 4