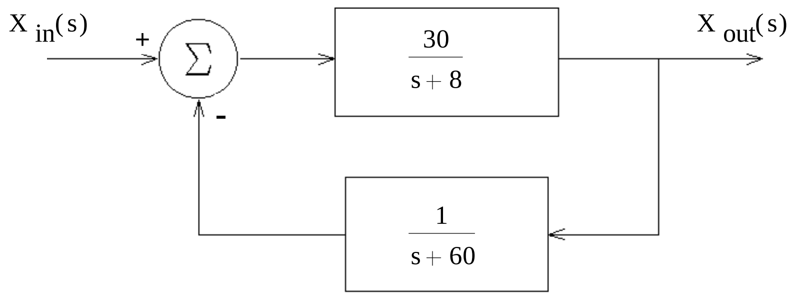
ECE 3510 homework # 4

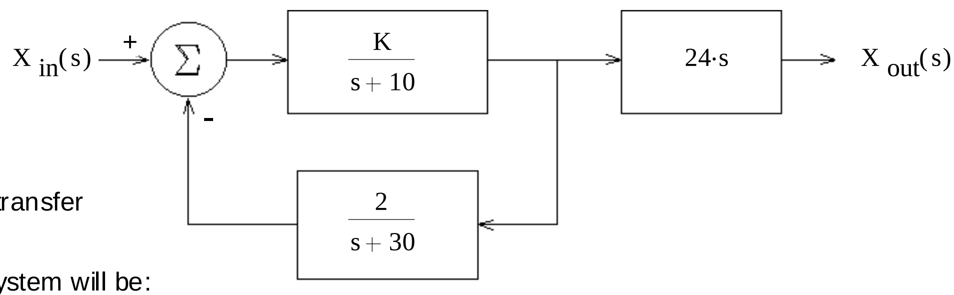
1. For each feedback system shown below, find the transfer function of the whole system, with feedback.

Find $H(s) = \dfrac{X_{out}(s)}{X_{in}(s)}$ For each. Simplify your expression for H(s) so that he numerator and denominator are both simple polynomials

a)



b) $H(s) = \dfrac{X_{out}(s)}{X_{in}(s)} = ?$



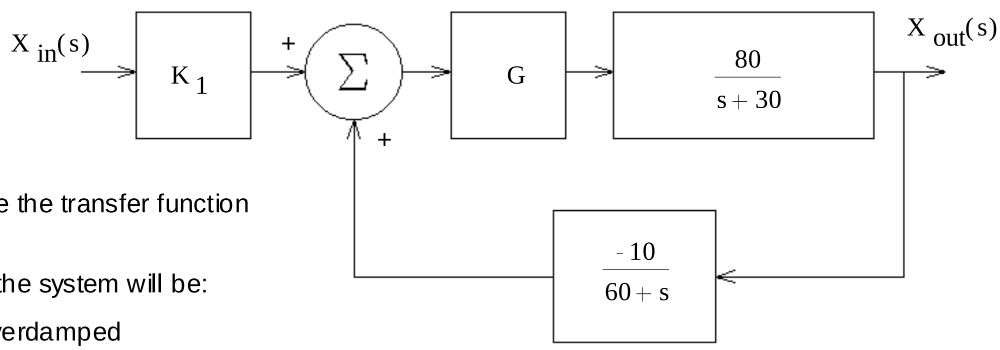
c) Find the value of K to make the transfer function critically damped.

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) $H(s) = \dfrac{X_{out}(s)}{X_{in}(s)} = ?$



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) $\dfrac{30 \cdot s + 1800}{s^2 + 68 \cdot s + 510}$ b) $\dfrac{K \cdot 24 \cdot s \cdot (s + 30)}{s^2 + 40 \cdot s + 300 + 2 \cdot K}$ c) 50 d) underdamped e) $0, -30$

f) $K_1 \cdot \dfrac{G \cdot 80 \cdot s + G \cdot 4800}{s^2 + 90 \cdot s + 800 \cdot G + 1800}$ g) 0.28125

h) overdamped i) -60

2. $\dfrac{H_1 \cdot H_4 + H_2 \cdot H_4 - H_1 \cdot H_2 \cdot H_3 + H_1 \cdot H_3}{1 + H_1}$

3.

	Stable	Problem input
a)	yes	
b)	no	$\cos(2 \cdot t)$
c)	yes	
d)	no	any input, even noise
e)	no	1
f)	no	1

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