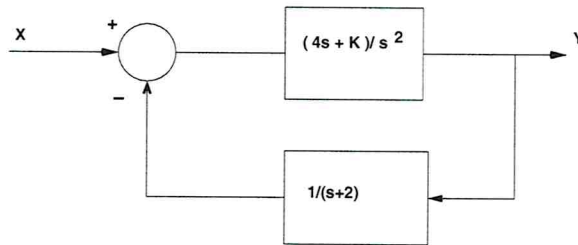


University of Massachusetts Lowell
Department of Electrical and Computer Engineering
16.413 Linear Feedback (4)

1. For the negative-feedback system



- a. What is the transfer function of the closed-loop system.
 - b. Find the characteristic equation of the closed-loop system.
 - c. Determine the condition on the the gain K for stability.
 - d. Can the system become marginally stable? If so for what value of K and what is the frequency of oscillation.
2. At the conclusion of an experiment you arrive at the result for the impulse response $h(t)$

$$h(t) = 5 e^{-t} \cos(2t)u(t)$$

Assuming the aforementioned response can be modelled by a second order system:

- a. Determine the damped natural frequency ω_d , the damping factor ζ and the natural frequency ω_n .
 - b. Find $H(s)$
 - c. Determine the step response of the system.
3. Consider the unity feedback system where

$$GH = \frac{K(s-2)}{(s+1)(s+2)(s+3)(s+4)}$$

- a. Determine the conditions on K for stability of the closed loop system.