Assignment Part 1

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Laplace Transforms

1. Calculate the Laplace Transform $X(s)$ of the signal $x(t)$:

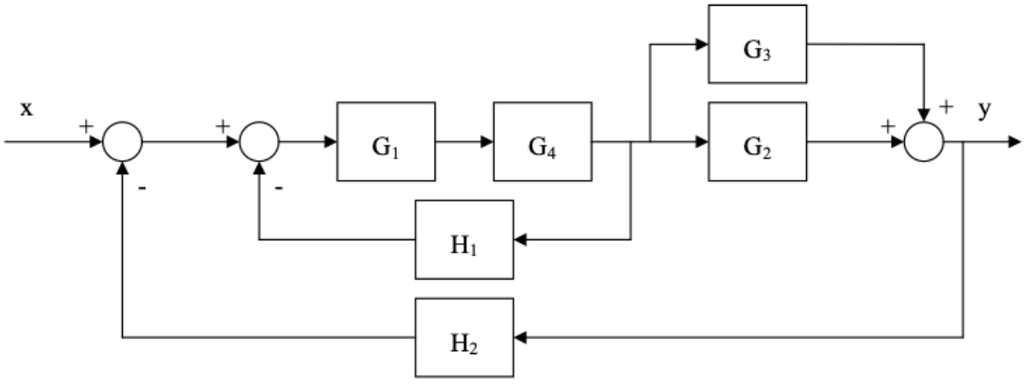
$$x(t) = (4t - 3cos(5t))e^{-2t}$$

1. Calculate the Inverse Laplace Transform $g(t)$ of the transfer function $G(s)$:

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

Block Diagrams

1. Calculate the equivalent transfer function $G_t(s) = \frac{Y(s)}{X(s)}$ of the following block diagram:



System Response

1. Write the transfer function to a step input of a second order system characterised by:

- Static gain $G(0) = 5$
- Damping ratio $\xi = 0.5$
- Settling time $t_s = 3s$
- No zeros

1. Plot the qualitative behaviour of the step response of the system:

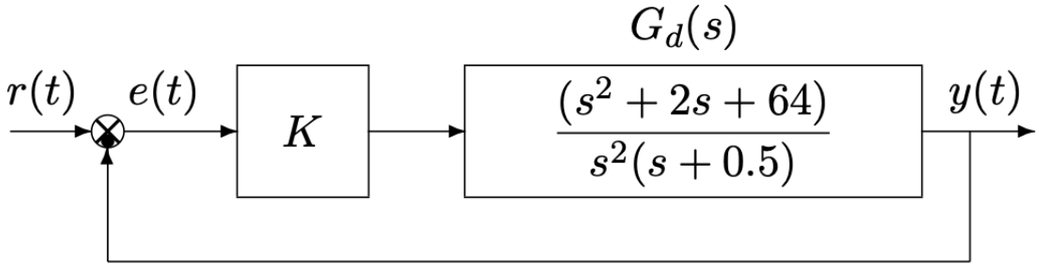
$$G(s) = \frac{20(3 + 0.1s)(s^2 + 10s + 160)}{(2s + 10)(0.1s + 5)(s^2 + 2s + 400)}$$

1. For the system $G(s)$ defined above, calculate:

- Its steady state value y_∞ to a step input (when $t \to \infty$)
- Its settling time t_s
- If the system oscillates, calculate the period T_ω of the oscillation

Routh Criterion

1. Determine the values of K for which the following feedback system is asymptotically stable:



Bode Plots

1. Plot the Bode amplitude and phase plots for the system $G_d(s)$ discussed in question 7.