

Date Due: Khordad 4, 1391

Homework 7

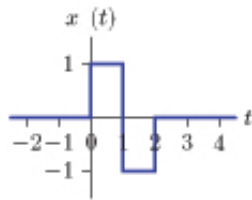
Problems

- Determine the Laplace transforms (including the regions of convergence) of each of the following signals.

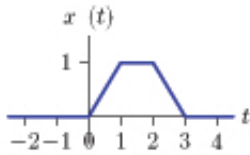
a. $x(t) = e^{-2(t-3)}u(t-3)$

b. $x(t) = (1 - (1-t)e^{-3t})u(t)$

c. $x(t) = |t|e^{-|t|}$



d.



e.

- Determine and sketch all possible signals with Laplace transforms of the following forms. For each signal, indicate the associated region of convergence.

a. $X(s) = \frac{s+2}{(s+1)^2}$

b. $X(s) = \frac{1}{s^2(s+1)}$

c. $X(s) = \frac{s+1}{s^2+2s+2}$

d. $X(s) = \left(\frac{1-e^{-s}}{s}\right)^2$

- A system is represented by the following differential equation:

$$\frac{dy(t)}{dt} + y(t) = \frac{dx(t)}{dt} - x(t)$$

- Determine the step response of the system with using Laplace transforms.
- Determine the output $y(t)$ when $x(t) = e^{-t}u(t)$ with using laplace transforms.

4.

- Use the initial and final value theorems (where applicable) to find $x(0)$ and $x(\infty)$ for the signals with the following Laplace transforms:

- $\frac{1-e^{-sT}}{s}$

2. $(\frac{1}{s})e^{-sT}$

3. $\frac{1}{s(s+1)^2}$

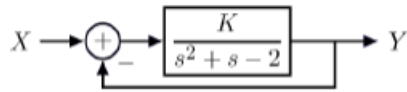
4. $\frac{1}{s^2(s+1)}$

5. $\frac{1}{s^2+1}$

6. $\frac{(s+1)^2-1}{((s+1)^2+1)^2}$

b. Find the inverse Laplace transforms for each of the previous parts and show that the time waveforms and initial and final values agree.

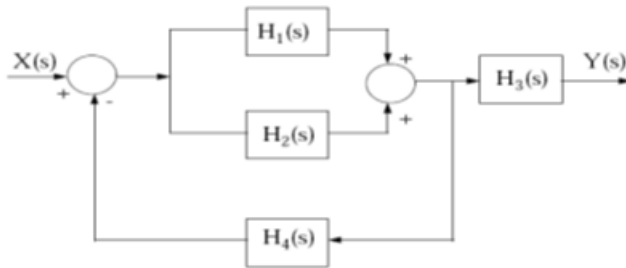
5. Consider the following feedback system in which the box represents a causal LTI CT system that is represented by its system function.



a. Determine the range of K for which this feedback system is stable.

b. Determine the range of K for which this feedback system has real-valued poles.

6. Determine $H(s) = Y(s)/X(s)$ in the following system.



7. Determine (by giving proof) whether each of following statements are true or false.

a. If $x(t)$ be a odd function, then $X(s) = -X(-s)$.

b. An absolute integrable signal which has a pole at $s=3$ can be right sided.