

HW Assignment 6

Due date: Thursday 14/4/2016

Question 1

Calculate the inverse Laplace transforms for the following functions and ROCs:

1. $X(s) = \frac{s^2 + 1}{(s+1)^2} \quad \text{Re}\{s\} > -1$

2. $X(s) = \frac{s+1}{(s+1)^2 + 4} \quad \text{Re}\{s\} > -1$

Question 2

The signal $x(t) = u(t)e^{-t}$ is passed through an LTI system $h(t) = u(t)e^{-3t}$. The output is marked $y(t)$.

- Calculate $X(s)$ and $H(s)$.
- Using the convolution property of the Laplace transform, find $Y(s)$.
- Calculate the output $y(t)$.

Question 3

Consider the LTI system defined by the ODE

$$\ddot{y}(t) - \dot{y}(t) - 2y(t) = x(t)$$

1. Calculate the transfer function $H(s)$. Sketch the system's zeros and poles on the s-plane.
2. Sketch the ROC for each of the following cases:
 - 2.1. The system is stable.
 - 2.2. The system is casual.
 - 2.3. The system is neither stable nor casual.
3. Determine $h(t)$ when the system is casual.

Question 4

What is the casual and stable impulse response of the system

$$\ddot{y}(t) + 5\dot{y}(t) + 7y(t) = 2\ddot{x}(t) + \dot{x}(t)$$

where $x(t)$ is the input signal and $y(t)$.

Remember the solution (Hint: Ex2 Q2)?