

Lab 5

EE 324: Signals and Systems II

In this lab section we will utilize Laplace transformation to analyze continuous time dynamical systems.

1 Prelab assignment

1. Learn to use basic matlab functions for control systems, e.g., tf, zpk, residue, pole, zero, impulse, step, initial, lsim, bode.

2. Compute the zeros and poles of the following systems and determine their stabilities

a) $H(s) = \frac{1}{s+1}$

b) $H(s) = \frac{1}{s-1}$

c) $H(s) = \frac{s-1}{s^2+s+1}$

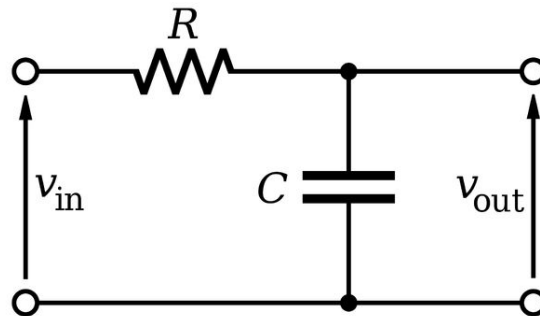
d) $H(s) = \frac{s-3}{s^2-s+2}$

3. Simulate the response of a) with input $x(t) = \sin t$ and initial condition $y(0^-) = 2$, using simulink. You can realize the system using the integrator block $\frac{1}{s}$.

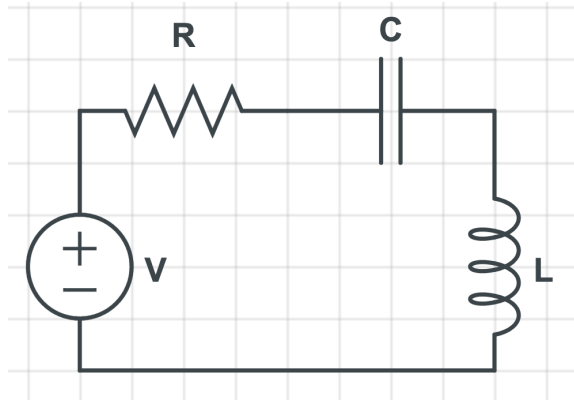
4. Simulate the response of a) with input $x(t) = \sin t$ and initial condition $y(0^-) = 2$, using lsim function in matlab.

5. Derive the transfer functions associated with the following systems

i) Input: v_{in} , output: v_{out}



ii) Input: v , output: voltage of C



2 Lab assignment

1. Simulate and plot the response of a), b), c) and d) with input $x(t) = \sin t$ and zero initial condition using simulink. Explain your observations.
2. Simulate the response of system (i) with parameters $R = 500k\Omega$, $C = 1\mu F$, input $x = 1V$ and initial condition $v_C(0^-) = 3V$ using simulink. Plot the natural response, forced response and total response.
3. Simulate the response of system (i) with parameters $R = 500k\Omega$, $C = 1\mu F$, input $x = 1V$ and initial condition $v_C(0^-) = 3V$ using lsim function in matlab. Plot the natural response, forced response and total response.
4. Simulate the response of system (ii) with parameters $R = 500\Omega$, $C = 1mF$, $L = 1H$, input $x = 2V$ and initial conditions $v_C(0^-) = 2V$, $i_L(0^-) = 1A$ using simulink. Plot the natural response, forced response and total response.
5. Simulate the response of system (ii) with parameters $R = 500\Omega$, $C = 1mF$, $L = 1H$, input $x = 2V$ and initial conditions $v_C(0^-) = 2V$, $i_L(0^-) = 1A$ using lsim function. Plot the natural response, forced response and total response.
6. Simulate the response of system (ii) with parameters $R = 500\Omega$, $C = 1mF$, $L = 1H$, input $x = 2\sin(2\pi t)V$ and initial conditions $v_C(0^-) = 2V$, $i_L(0^-) = 1A$ using simulink. Plot the natural response, forced response and total response.
7. Simulate the response of system (ii) with parameters $R = 500\Omega$, $C = 1mF$, $L = 1H$, input $x = 2\sin(2\pi t)V$ and initial conditions $v_C(0^-) = 2V$, $i_L(0^-) = 1A$ using lsim function. Plot the natural response, forced response and total response.