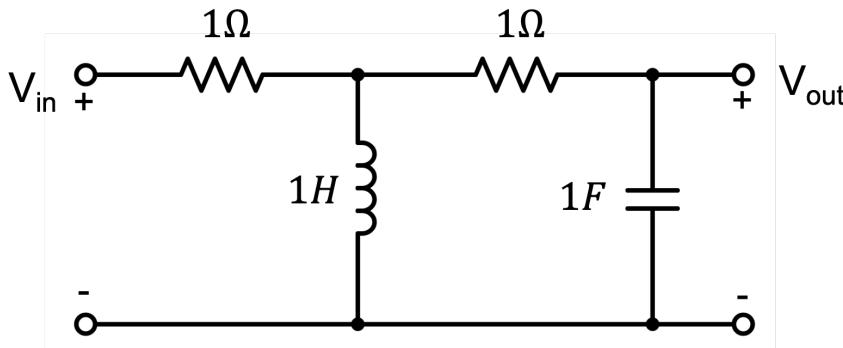


For the circuit below, $V_{in}(t) = 1 \text{ V}$ for $t < 0$, and $V_{in}(t) = (1 - e^{-t})u(t) \text{ V}$ for $t > 0$



- (10 points) Calculate the initial capacitor voltages and inductor currents
- (10 points) Draw the **s**-domain representation of the circuit.
- (10 points) Find the **s**-domain representation of the input $V_{in}(t)$ for $t > 0$.
- (20 points) Write mesh current equations in the **s**-domain that could be used to find the current through the capacitor. Use these equations to fill in the entries in the Cramer's method matrices shown below. Here, \mathbf{I}_1 and \mathbf{I}_2 represent the mesh currents, and \mathbf{V}_1 , \mathbf{V}_2 respectively represent voltage sources.

$$\begin{pmatrix} \mathbf{A}_1 & \mathbf{A}_2 \\ \mathbf{A}_3 & \mathbf{A}_4 \end{pmatrix} \begin{pmatrix} \mathbf{I}_1 \\ \mathbf{I}_2 \end{pmatrix} = \begin{pmatrix} \mathbf{V}_1 \\ \mathbf{V}_2 \end{pmatrix}$$

- (15 points) Find the output $\mathbf{V}_{out}(s)$ in the Laplace domain.
- (15 points) Find the output $v_{out}(t)$ in the time domain.

2. (20) Here is the Matlab code for finding the output of an RC circuit to a given input. Change the input to $x(t) = u(t - 1) - u(t - 3)$, and plot the output $y(t)$.

```
RCPulseExample.m *  ×  +
1 % This example needs the Symbolic Math Toolbox of MATLAB
2 clear; % Start by clearing the workspace
3 syms t s X(s) H(s) Y(s) x(t) h(t) y(t);% Declare the symbols
4
5 X(s) = 1/s-exp(-s)/s; % specify the input X(s)
6 H(s) = 2/(s+2); % specify the system H(s)
7 Y(s) = X(s)*H(s); % System output in the Laplace domain
8 x(t) = ilaplace(X); % inverse Laplace transform x(t)
9 y(t) = ilaplace(Y); % inverse Laplace transform y(t)
10
11 % Plot the results
12 time = 0:0.01:5; % array of time points for plotting
13 figure; plot(time,x(time),time,y(time),'LineWidth',2);
14 xlabel('t(sec)', 'FontSize',12,'FontWeight','bold');
15 ylabel('Voltage (V)', 'FontSize',12,'FontWeight','bold');
16
17 % Pause for the user and close the figure
18 pause;
19 close all;
```