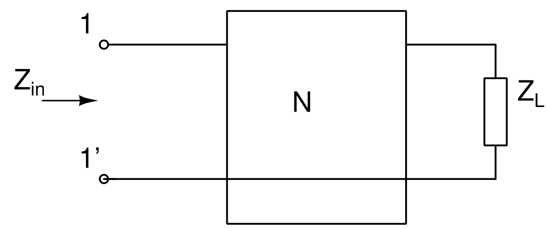
EE2015: Electric Circuits and Networks

Tutorial 5

(September 13, 2024)

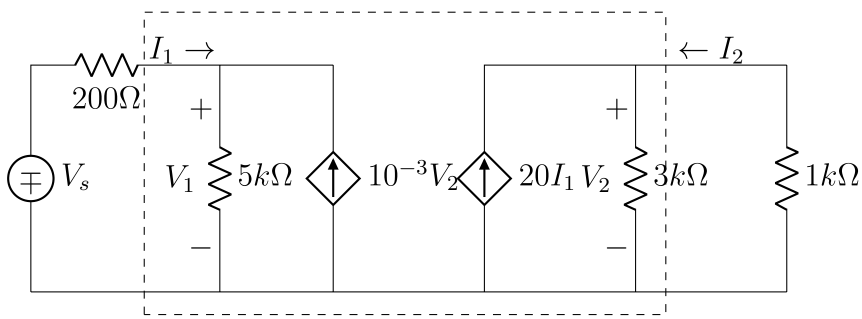
1. Let the open circuit impedance matrix of network N be

$$\begin{bmatrix} 0 & -r \\ r & 0 \end{bmatrix}.$$



Find $Z_{in}(s)$ in terms of r and $Z_L(s)$. If $Z_L(s)$ is $1/sC$, show that the network behaves like an inductor at the input terminals.

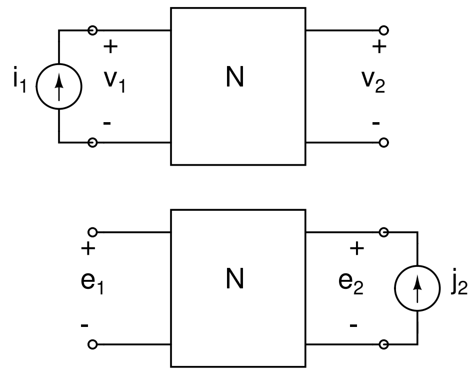
2. Find the Z parameters for the 2 port network marked with dotted lines and then find the Z_{out} (impedance seen by the $1k\Omega$ resistor) for the terminated two port network.



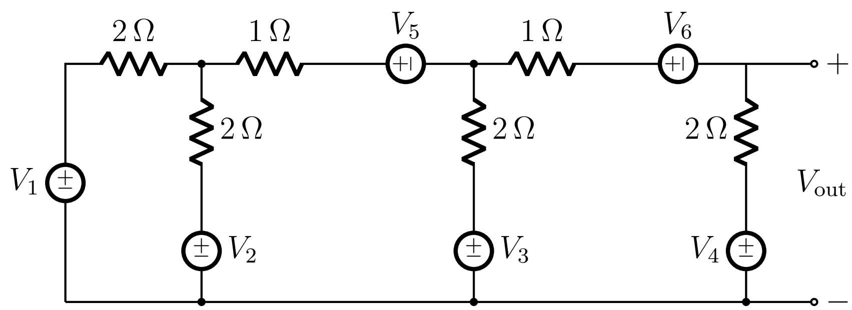
3. The two port network N is an RLC network. If $i_1(t) = \delta(t)$, $v_2(t) = (3e^{-t} + 5e^{-t})u(t)$.

   a. If $j_2(t) = u(t)$, find $e_1(t)$

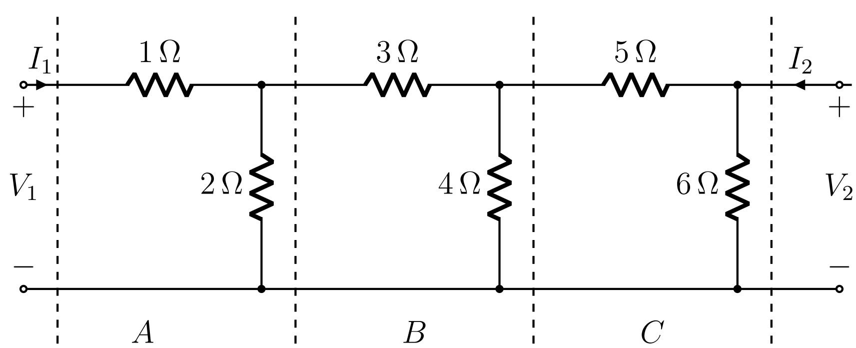
   b. If $j_2(t) = \cos 500tu(t)$, find the response $e_1(t)$.



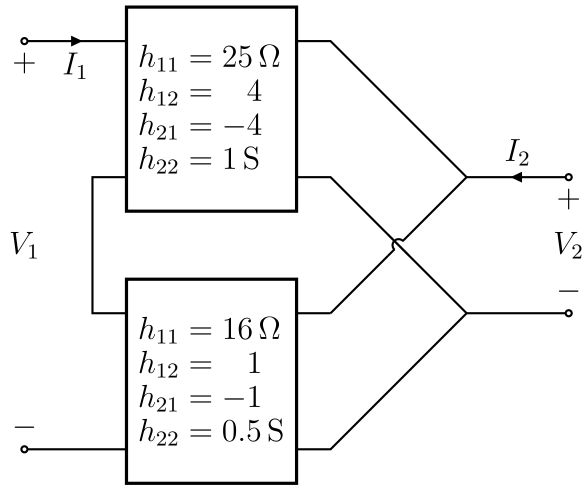
4. For the circuit given below, use reciprocity and superposition to determine V_{out} in terms of V_k, $k = 1, 2, \ldots, 6$.



5. The two-port network shown below can be viewed as a cascaded combination of three two-port networks A, B, and C.
   (a) Find the transmission parameters of each network.
   (b) Find the transmission parameters of the overall network.



6. A series-parallel connection of two two-port networks is shown on the right. Terminals 1 and 1' and 2 and 2' are connected. Determine the z-parameters of the overall network.



7. In the circuit below, find the **z** parameters individually for the networks A and B. Now, if a voltage source V_s is connected between terminals a and b and a load resistor $R_L = 10\Omega$ is connected between terminals c and d, find the voltage gain $\frac{V_4}{V_1}$ using the **z** parameters of the networks A and B.