

RFCD Test-2

1. [10 marks] Using the concept of *Symmetric Circuit Analysis*, determine the scattering matrix of the simple 2-port device shown in Fig. 1:

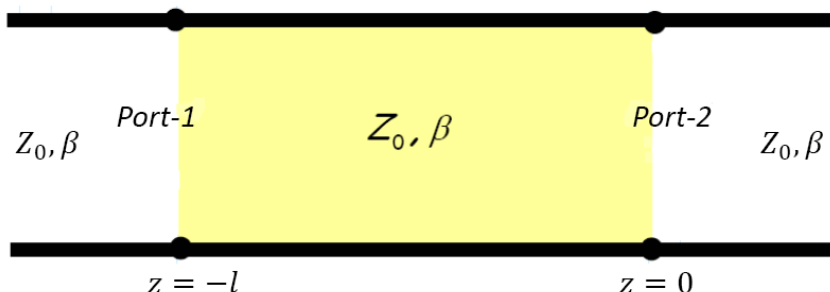


Fig. 1

2. (a) [5 marks] Consider the circuit shown in Fig. 2:

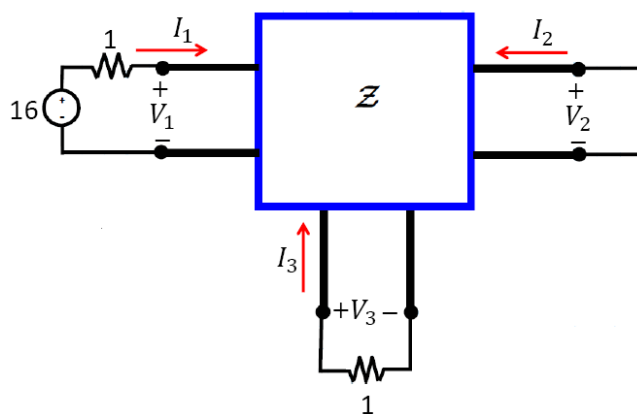


Fig. 2

The 3-port device is characterized by the impedance matrix: $Z = \begin{bmatrix} 2 & 1 & 2 \\ 1 & 1 & 4 \\ 2 & 4 & 1 \end{bmatrix}$

Determine all port currents I_1 , I_2 , and I_3 .

2. (b) [5 marks] Show that it is impossible to realize a 3-port device that is lossless, reciprocal, and matched at all ports. Is it possible to construct a non-reciprocal three-port network that is lossless and matched at all ports?

3. [10 marks] A lossless, reciprocal 3-port device has S-parameters of $S_{11} = 1/2$, $S_{31} = 1/\sqrt{2}$ and $S_{33} = 0$. It is also known that all scattering parameters are real. Find the remaining 6 scattering parameters.