

EEE 451 / 551

HW # 10

- ① Find the ABCD parameters of the following circuits (Fig.A and Fig.B)

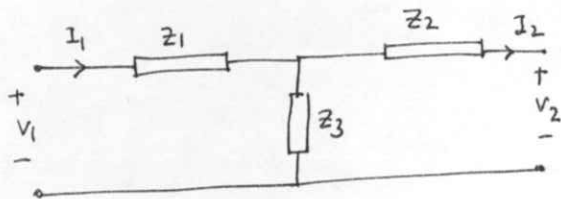


Fig.A

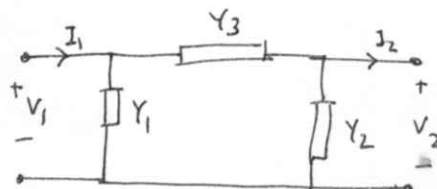
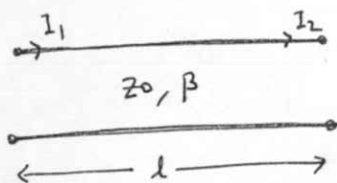
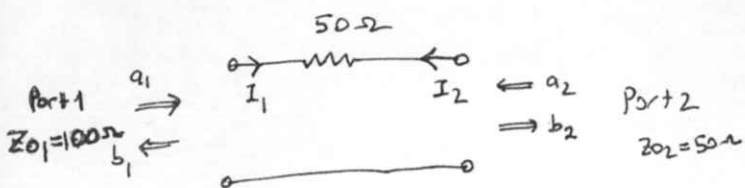


Fig.B

- ② Find the ABCD parameters of a piece of tr. line shown in Fig.C.

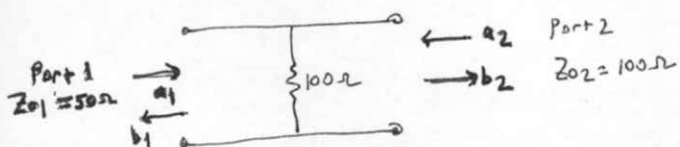


- ③ Consider the lump circuit shown below made with a series resistor of 50Ω . The port 1 and port 2 characteristics impedances are 100Ω and 50Ω , respectively.



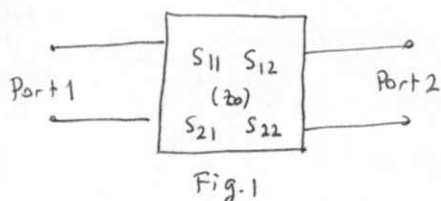
- Calculate S_{11}
- Calculate S_{22}
- Calculate S_{21}
- Find S_{12}

- ④ Consider the lump circuit shown below made with a shunt resistor of 100Ω . The input port 1 and output port 2 characteristics impedances are 50Ω and 100Ω , respectively.



- Calculate
- S_{11}
 - S_{22}
 - S_{21}
 - S_{12}

- ⑤ Consider the 2-port network shown in Fig. 1. Using a set of measurements the reflection coefficients S_{11} and S_{22} are measured as $S_{11} = |S_{11}| e^{j\theta_1}$ and $S_{22} = |S_{22}| e^{j\theta_2}$. It is known that this network is lossless and reciprocal. Using these informations, determine S_{21} and S_{12} in terms of $|S_{11}|$, θ_1 and θ_2 and $|S_{22}|$. (i.e. if $S_{12} = |S_{12}| e^{j\phi_1}$ and $S_{21} = |S_{21}| e^{j\phi_2}$, then what is $|S_{12}|$, $|S_{21}|$, ϕ_1 and ϕ_2 ?)



- ⑥ Consider a three port network with the following $[S]$ matrix: $[S] = \begin{bmatrix} S_{11} & S_{12} & S_{13} \\ S_{21} & S_{12} & S_{23} \\ S_{31} & S_{32} & S_{33} \end{bmatrix}$

- (a) If all ports of this network are matched, determine which S_{ij} terms of this $[S]$ matrix will vanish.
- (b) In addition to the condition given in part (a), assume that the network is reciprocal and lossless (i.e. we have a network which is reciprocal, lossless and all ports are matched). Under these conditions, is this three-port network a physically realizable device? Explain clearly.
- (c) Let this network be nonreciprocal (still lossless and all ports are matched) and let $S_{12} = S_{23} = S_{31} = 0$. Find the values of S_{ij} if all phases of S_{ij} are zero.

- ⑦ Find P_{in} for the following network in terms of the given S-parameters.

