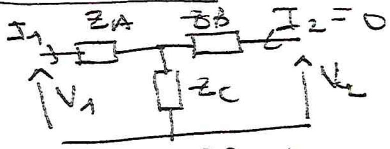
Matière : Dispositifs RF (Passifs et Actifs) et Micro-ondes
Master 2 : Système des Télécommunications
Année : 2018/2019.

Corrigé type EMD

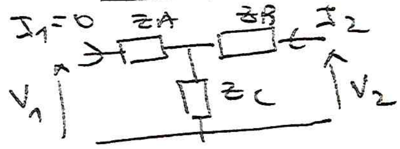
Exercice 1 (7 Pts)

1- $Z_{11} = \frac{V_1}{I_1}\Big|_{I_2=0} \rightarrow V_1 = (Z_A+Z_C)I_1 \rightarrow \frac{V_1}{I_1} = \boxed{Z_{11} = Z_A+Z_C}$ (1)



- $Z_{12} = \frac{V_1}{I_2}\Big|_{I_1=0} \rightarrow V_1 = V_2\cdot\frac{Z_C}{Z_C+Z_B}$ (diviseur de tension)

et $V_2 = (Z_B+Z_C)I_2 \rightarrow V_1 = \frac{Z_C}{Z_C+Z_B}\times(Z_B+Z_C)I_2$.



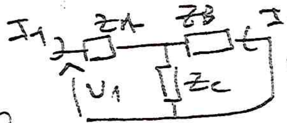
$\frac{V_1}{I_2} = \boxed{Z_{12} = Z_C}$ (1)

- $Z_{21} = \frac{V_2}{I_1}\Big|_{I_2=0} \rightarrow V_2 = \frac{Z_C}{Z_C+Z_A}V_1$ et $V_1 = (Z_A+Z_C)I_1$ schémas (1)

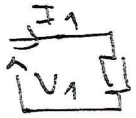
$V_2 = \frac{Z_C}{Z_C+Z_A}\times(Z_A+Z_C)I_1 \rightarrow \frac{V_2}{I_1} = \boxed{Z_{21} = Z_C}$ (1)

- $Z_{22} = \frac{V_2}{I_2}\Big|_{I_1=0} \rightarrow V_2 = (Z_C+Z_B)I_2 \rightarrow \frac{V_2}{I_2} = \boxed{Z_{22} = Z_C+Z_B}$ (1)

2- $Y_{11} = \frac{I_1}{V_1}\Big|_{V_2=0} \rightarrow$



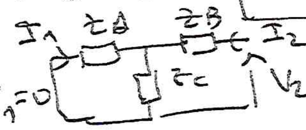
$V_2=0 \equiv$



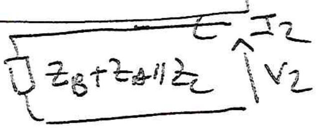
$Z_A + Z_B // Z_C \rightarrow$

$Y_{11} = \frac{I_1}{V_1} = \frac{1}{Z_A+Z_B//Z_C} \rightarrow \boxed{Y_{11} = \frac{Z_B+Z_C}{Z_AZ_B+Z_AZ_C+Z_BZ_C}}$ (1)

- $Y_{22} = \frac{I_2}{V_2}\Big|_{V_1=0} \rightarrow V_1=0$



$\equiv$



$\rightarrow \boxed{Y_{22} = \frac{Z_A+Z_C}{Z_AZ_B+Z_AZ_C+Z_BZ_C}}$ (1)

Exercice 2 (7 Points)

1- Coefficient de réflexion en sortie nul (entrée adaptée) $\rightarrow \boxed{S_{22}=0}$

$\boxed{S_{11}=0}$ (Par symétrie)

- Coefficient d'atténuation : $A = -20\log|S_{21}| = 20 \rightarrow \log|S_{21}| = -1 \rightarrow$

$|S_{21}| = 10^{-1} \rightarrow \boxed{|S_{21}| = 0,1}$ $\boxed{S_{21} = 0,1\angle\pi/6}$

- Déphasage de transmission : $\phi_{21} = 30° = \pi/6 \rightarrow$

$\boxed{S_{12} = 0,1\angle\pi/6}$ (Par réciprocité) $\rightarrow [S] = \begin{bmatrix} 0\;(1) & 0,1\angle\pi/6\;(1) \\ 0,1\angle\pi/6\;(1) & (1)\;0 \end{bmatrix}$.

2- $z_{in} = \frac{z_L + j\tan(\beta\ell)}{1 + jz_L\tan(\beta\ell)}$, $\beta\ell = \frac{2\pi}{\lambda}\cdot\frac{\lambda}{2} = \pi \rightarrow \tan\beta\ell = 0 \rightarrow \boxed{z_{in} = \infty}$

$\Gamma_L = \frac{z_{in}-1}{z_{in}+1} = \frac{1-1/z_{in}}{1+1/z_{in}} \rightarrow \boxed{\Gamma_L = 1}$ (1)

$\Gamma_{in} = S_{11} + \frac{S_{12}\cdot S_{21}\Gamma_L}{1-S_{22}\cdot\Gamma_L} \rightarrow S_{11}=S_{22}=0$ et $S_{21}=S_{12} \rightarrow \boxed{\Gamma_{in} = S_{12}^2}$ (1)

$\Gamma_{in} = |S_{12}|\cdot|S_{12}|\,\angle\phi_{12}+\phi_{12} = (0,1)^2\,\angle\pi/6+\pi/6 \rightarrow \boxed{\Gamma_{in} = 0.01\angle\pi/3}$ (1)

Exercice 3 (6 points)

Une ligne $\lambda/4$ transforme un C.C. en C.O. Dans ces conditions tout se passe comme si l'accès N° 3 était chargé par un C.O.

$S_{11} = 0$ (0,5)

$a_2 = 0$ (accès adapté en sortie) (0,5)

$a_3 = b_3$ (accès en C.O ($\Gamma_3 = +1$)) (1)

Le développement de la matrice [S] nous permet de déterminer le coefficient de réflexion de l'accès N° 1 qui est donné par:

$\Gamma_{1in} = \frac{b_1}{a_1} = S_{13} \cdot \frac{a_3}{a_1}$ (1) . De plus: $\Gamma_{3in} = \frac{b_3}{a_3} = S_{33} + S_{31} \cdot \frac{a_1}{a_3} = 1$ (1)

$\rightarrow \frac{a_1}{a_3} = \frac{1 - S_{33}}{S_{31}} \rightarrow \frac{a_3}{a_1} = \frac{S_{31}}{1 - S_{33}} \rightarrow \boxed{\Gamma_{1in} = \frac{S_{13} \cdot S_{31}}{1 - S_{33}}}$ (1)

A-N: $\Gamma_{1in} = \frac{(-1/\sqrt{2}) \times (-1/\sqrt{2})}{1 - (1/\sqrt{2})(1/\sqrt{2})} \rightarrow \boxed{\Gamma_{1in} = 1}$ (1)