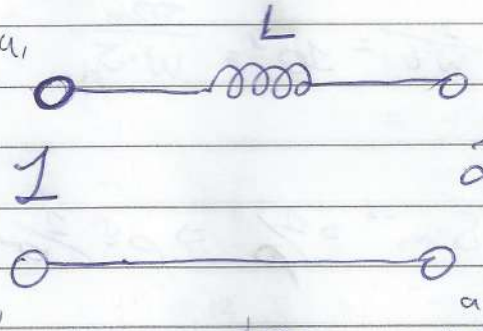
Circuitos RF
Gustavo Simas 2020/1

PRELAB 1

1) Equações Pseudo Power-Waves

2) Quadripolo
$L = 1_n H$



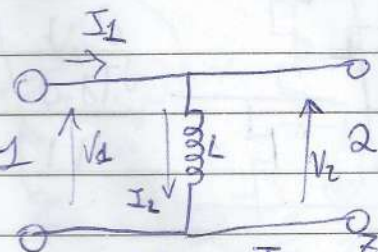
$Z_L = j\omega L$

3) $a_1 = \frac{V_1 + I_1 \cdot z_0}{2\cdot\sqrt{z_0}} = \frac{V_{i1}}{\sqrt{z_0}}$

$a_2 = \frac{V_2 + I_2 \cdot z_0}{2\cdot\sqrt{z_0}} = \frac{V_{i2}}{\sqrt{z_0}}$

$b_1 = \frac{V_1 - I_1 z_0}{2\sqrt{z_0}} = \frac{V_{r1}}{\sqrt{z_0}}$

$b_2 = \frac{V_2 - I_2 \cdot z_0}{2\sqrt{z_0}} = \frac{V_{r2}}{\sqrt{z_0}}$



$I_L = I_1 \frac{z_0}{z_L + z_0}$

$V_1 = z_L \cdot I_L$

$V_2 = V_1$

Para o indutor em paralelo:

$\Rightarrow S_{11} = \frac{b_1}{a_1}\Big|_{a_2=0}$

$\Rightarrow S_{11} = \frac{V_1 - I_1 \cdot z_0}{V_1 + I_1 \cdot z_0}$

$= \frac{(z_0 \cdot z_L / z_0 + z_L) - z_0}{(z_0 \cdot z_L / z_0 + z_L) + z_0}$

$= -z_0^2 / (2 z_L z_0 + z_0^2)$

$= \frac{-z_0}{2\cdot z_L + z_0} = \frac{-1}{2\cdot\frac{z_L}{z_0} + 1}$

$\Rightarrow S_{21} = \frac{b_2}{a_1}\Big|_{a_2=0} = \frac{V_2 - I_2 \cdot z_0}{V_1 + I_1 \cdot z_0}$

$\Rightarrow S_{21} = \frac{-I_2 \cdot z_0 - I_2 \cdot z_0}{I_1 \cdot \left[\left(\frac{z_L \cdot z_0}{z_L + z_0}\right) + z_0\right]}$

$= \frac{-2 \cdot I_1 \cdot \left(\frac{z_0}{z_L + z_0} - 1\right) \cdot z_0}{I_1 \cdot \left[\left(\frac{z_L \cdot z_0}{z_L + z_0}\right) + z_0\right]}$

$= \frac{-2 z_0^2 / z_L + z_0 + 2 \cdot z_0}{z_L \cdot z_0 / z_L + z_0 + z_0}$

⇓

$$S_{21} = \frac{-2\cdot Z_0/Z_L + 2\cdot(Z_L+Z_0)/Z_L}{1+\frac{Z_L+Z_0}{Z_L}} = \frac{2}{2+Z_0/Z_L}$$

Como REDE é RECÍPROCA: $S_{21} = S_{12}$

Como REDE é SIMÉTRICA: $S_{11} = S_{22}$

4) $S_{11} = S_{22} = \frac{-1}{2\cdot\frac{Z_L}{Z_0}+1} = \frac{-1}{2\cdot\frac{j\cdot 2\pi\cdot 900\cdot 10^6\cdot 20^{-9}}{50}+1}$

$f = 900\,MHz$

$Z_0 = 50\,\Omega$

$L = 1_n\,H$

$= -0,95 + j\,0,21$

$= 0,975 \angle 2,919\ rad$

$= 0,975 \angle 167,25°$

$S_{21} = S_{12} = \frac{2}{2+\frac{Z_0}{Z_L}} = \frac{2}{2+\frac{50}{j\cdot 2\pi\cdot 900\cdot 10^6\cdot 10^{-9}}}$

$= 0,0487 + j\,0,215$

$= 0,221 \angle 1,35\ rad$

$= 0,221 \angle 77,25°$

Logo: $S = \begin{bmatrix} 0,975\angle 167,25° & 0,221\angle 77,25° \\ 0,221\angle 77,25° & 0,975\angle 167,25° \end{bmatrix}$