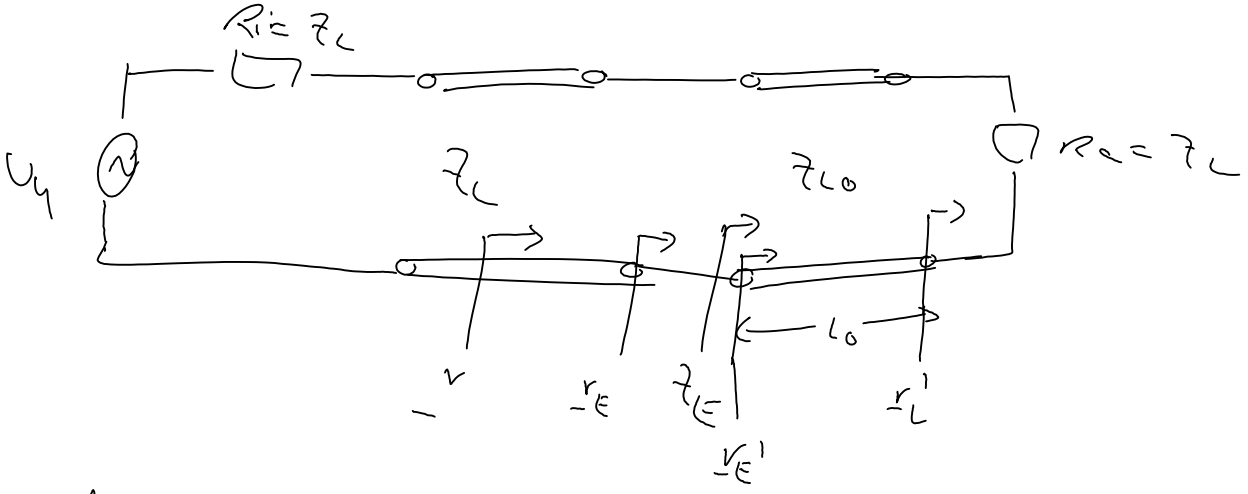
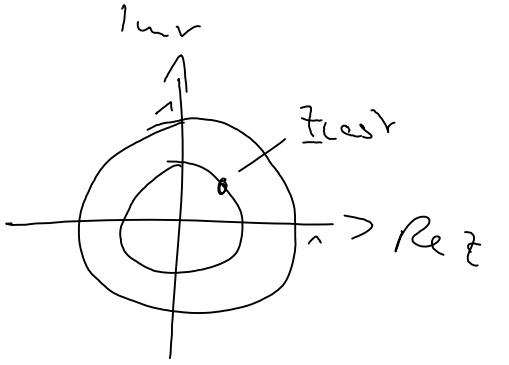
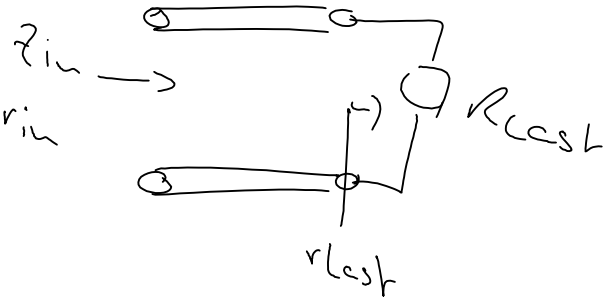
KGÜ 5

Montag, 16. Mai 2011
08:33

3.5







$$r_{in} = r_{last}\, e^{-j\beta L}$$

$\frac{\lambda}{2}$ Trafo $\quad Z_{in} = Z_{last}$

$$r_{in} = r_{last}$$

$$L = n \cdot \frac{\lambda}{2}$$

$\frac{\lambda}{4}$ -Trafo: $Z_{in} = \frac{Z_0^2}{Z_{last}} \qquad Z_{in} = \frac{1}{Z_{last}}$

$$r_{in} = -r_{last}$$

$$L = n \cdot \frac{\lambda}{2} + \frac{\lambda}{4}$$

2 Minima von $|\underline{r}|$: $\underline{r}=0 \Rightarrow \underline{r}_E = 0$

$\Rightarrow Z_E = Z_L \Rightarrow$ Leitung l_0 ist ein $\frac{\lambda}{2}$-Trafo

$l_{0,1} = \frac{n_1 c}{2 f_1}$ $\qquad \lambda = \frac{c}{f}$

$l_{0,2} = \frac{n_2 c}{2 f_2}$

$n_1 \frac{\lambda}{f_1} = n_2 \frac{\lambda}{f_2}$

$\frac{n_1}{n_2} = \frac{f_1}{f_2} = \frac{2}{3}$

$l_{01} = l_{02} = 3\,m$

$f_1 = 100\,MHz$ $\qquad f_2 = 150\,MHz$

$\lambda_1 = \frac{c_0}{f_1} = 3\,m$ $\qquad \lambda_2 = 2\,m$

$l_0 = n \cdot \frac{\lambda_1}{2} = (n+1)\frac{\lambda_2}{2}$

$\Rightarrow 1{,}5n = n+1 \Rightarrow n = 2$ $\qquad l_0 = 3\,m$

Maximum von $|\underline{r}|$ bei $f = 125\,MHz$

$z = 2{,}5\,m$

$\Rightarrow L_0 = 2 \cdot \frac{7}{2} + \frac{7}{4} \Rightarrow$ Leitung L_0 ist ein $\frac{7}{4}$ Trafo

$$z_E = \frac{z_0^2}{z_L} = \frac{z_0^2}{100\,\Omega}$$

$$|r| = |r_E| = 0{,}8$$

2 Fälle: $z_{L0} > z_L$ und $z_{L0} < z_L$

$$z_{in} = \frac{z_{L0}^2}{z_L} \qquad |r_E| = \left| \frac{z_E - z_L}{z_E + z_L} \right|$$

$$= \left| \frac{z_{L0}^2 - z_L^2}{z_{L0}^2 + z_L^2} \right|$$

$z_{L0} > z_L$:

$$0{,}8 = \frac{z_{L0}^2 - z_L^2}{z_{L0}^2 + z_L^2}$$

$$\Leftrightarrow 0{,}8\, z_{L0}^2 + 0{,}8\, z_L^2 = z_{L0}^2 - z_L^2$$

$$z_{L0} = \sqrt{\frac{+1{,}8\, z_L^2}{+0{,}2}} = 300\,\Omega$$

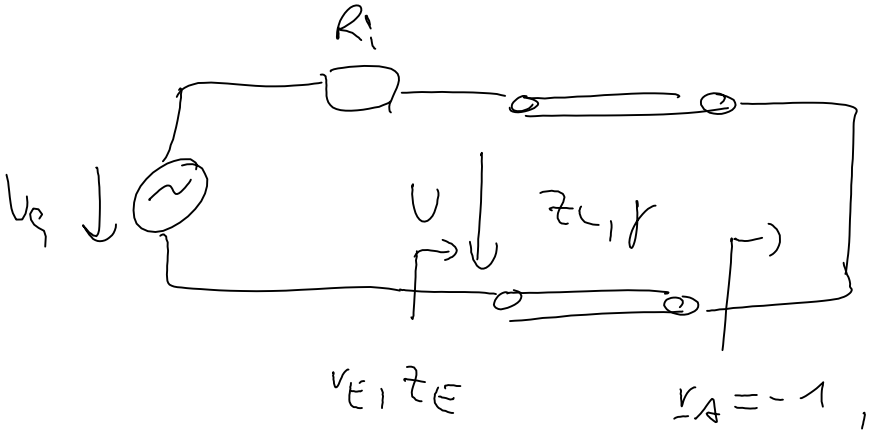
$z_{L0} < z_L$: $0{,}8 = -\frac{z_{L0}^2 + z_L^2}{}$

$$Z_{L0}^2 + Z_L^2$$

$$0{,}8\, Z_{L0}^2 + 0{,}8\, Z_L^2 = -Z_{L0}^2 + Z_L^2$$

$$Z_{L0} = \sqrt{\frac{0{,}2\, Z_L^2}{1{,}8}} = 33{,}3\,\Omega$$

A 2



(S. 22/23 Script)

$$\underline{U} = \underline{U}_p + \underline{U}_r$$

$$\Rightarrow \frac{\underline{U}}{\underline{U}_p} = 1 + \underline{r}_E \quad \text{mit} \quad \underline{r}_E = \frac{\underline{U}_r}{\underline{U}_p}$$

$|\underline{U}|$ max. für $r_E = 1$ (Leerlauf)

$|\underline{U}|$ minimal $r_E = -1$ (Kurzschluss)

Minima bei $f = 100\,\text{MHz}, 200\,\text{MHz}$
$\lambda = 3\,\text{m}$ $\lambda = 1{,}5\,\text{m}$

durch KS → KS $\Rightarrow \frac{\lambda}{2}$ Trafo

$$L = n \cdot \frac{\lambda}{2} = \frac{n \cdot c}{2f}$$

$$L = \frac{n_1}{2} \cdot 3\,\text{m} \doteq \frac{n_2}{2} \cdot 1{,}5\,\text{m}$$

und $n_2 = n_1 + 1$ (aufeinanderfolgende Minima)

$$\frac{n_1}{n_2} = \frac{1{,}5\,\text{m}}{3\,\text{m}} \Rightarrow n_1 = 1$$

$$\Rightarrow L = n_1 \frac{\lambda_1}{2} = 1{,}5\,\text{m}$$

Maximum bei $f = 150\,\text{MHz}$ ($\lambda = 2\,\text{m}$)

$\Rightarrow \frac{\lambda}{4}$ Trafo (KS → „L")

$$r_{in} \approx -r_{Last} \approx 1$$

$$r_E = r_A \underbrace{e^{-j2L\beta}}_{=1} \; e^{+2L\alpha} = e^{2L\alpha}$$

$\Rightarrow r_E, z_E$ reell

$$\left|\frac{U}{U_q}\right| = \frac{z_E}{R_i + z_E} \quad \Rightarrow z_E = 0{,}8 \cdot (R_i + z_E)$$

$$z_E = \frac{0{,}8\, R_i}{0{,}2} = 4\,k\Omega$$

$$r_E = \frac{3{,}9}{8\,\Omega} = 0{,}4875$$

$$\Rightarrow \alpha_{Np} = -\frac{1}{2L} \cdot \ln\left(\frac{3{,}9}{8\,\Omega}\right) = \frac{1}{20\,m}\ \frac{Np}{m}$$

$$\alpha_{dB} = \alpha_{Np} \cdot \underbrace{\frac{20\,dB}{\ln 10 \cdot Np}}_{1\,Np = 8{,}686\,dB} = 3{,}2387\ \frac{dB}{100\,m}$$