P3 - ELT 225 - MAG 2

Nome: Wéverson Frederits de O. Alves MATRICULA: 96708 Data: 9/12/20

① $\alpha = 0$, $V_g = 100\angle 0°\ V$, $R_g = 25\,\Omega$, $f = 100\ MHz$, $l_1 = 2m$, $\varepsilon_{r_1} = 2.25$

$Z_{01} = 50\,\Omega$, $Z_{L1} = 50 + j50$, $\underline{l_2 = 1m,\ Z_{02} = 75\,\Omega,\ Z_{L2} = 50 + j10\,\Omega,\ \varepsilon_{r_2} = 2.25}$

$\underline{\varepsilon_{r_3} = 4,\ Z_{03} = 100\,\Omega,\ l_3 = 2m,\ Z_{L3} = 100 - j50\,\Omega}$

a)

$$z_{L2} = \frac{Z_{L2}}{Z_{02}} = \frac{50 + 10j}{75} = 0.667 + 0.133j$$

$$z_{L3} = \frac{Z_{L3}}{Z_{03}} = \frac{100 - j50}{100} = 1 - 0.5j$$

$$\beta_2 = \frac{2\pi f}{\frac{1}{\sqrt{\varepsilon\mu}}} = 2\pi f\sqrt{\varepsilon_0\mu_0 2.25} = 3.144 = \beta_1$$

$$\boxed{\beta_2 l_2 = 3.144} = \quad \boxed{\beta_1 l_1 = 6.288}$$

$$\beta_3 = 2\pi f\sqrt{4\mu_0\varepsilon_0} = 4.192$$

$$\boxed{\beta_3 l_3 = 8.384}$$

$$Z_{in_2} = 75\left[\frac{(50+10j) + j\,tg(3.144)\,75}{75 + j(50 + j10)\,tg(3.144)}\right] = 51.016 + 10.077j$$

$$Z_{in_3} = 100\left[\frac{(100 - j50) + j100\,tg(6.288)}{100 + j(100 - j50)\,tg(6.288)}\right] = 133.348 + 47.134j$$

$$\lambda_1 = \frac{2\pi}{\beta_1} = 1.998\ m$$

$$\lambda_3 = \frac{2\pi}{\beta_3} = 1.499\ m$$

$$\begin{cases}\lambda_1 - 1.998\ m\\ \lambda_1' - 2\ m\end{cases} \quad \lambda' = 1.001\lambda$$

$$\begin{cases}\lambda_2 - 1.998\ m\\ \lambda_2' - 1\ m\end{cases} \quad \lambda' = 0.501\lambda$$

$$\begin{cases}\lambda_3 - 1.499\\ \lambda_3' - 2\end{cases} \quad \lambda_3' = 1.334\lambda$$

$$Z_{eq} = Z_{in_3} // Z_{in_2} = 37.063 + 8.83j \rightarrow Z_{eq_2} = Z_{L1} + Z_{eq} = 86.53 + j58.83$$

$$Z_{in_1} = 50\left[\frac{Z_{eq_1} + j50\,tg(3.144)}{50 + jZ_{eq_1}\,tg(3.144)}\right] = 87.89 + j59.89$$

$$I_0 = \frac{100\angle 0°}{25 + Z_{in_1}} = 0.691 - 0.367j = 0.783\angle\underline{-0.488\ rad}$$

$$V_1 = 55.7654 \quad e \quad V_2 = V_3 = 29.62\ V$$

$$P_{Z_{L1}} = \frac{55.76^2}{2.50} = 31.1W \quad P_2 = \frac{29.62}{2 \times 51} = 8.601W \quad P_3 = \frac{29.62}{133.3 \times 2} = 3.29W$$

b) $S = \dfrac{1 + |\Gamma_c|}{1 - |\Gamma_c|} = 2.62$

i) $\Gamma_c = \dfrac{50 + j50 - 50}{50 + j50 + 50} = 0.45\angle 63.43^\circ$

ii) $\Gamma_c = \dfrac{50 + j10 - 75}{50 + j10 + 75} = 0.215\angle 153.6$

$S = -1.55$

iii) $\Gamma_c = \dfrac{100 - j50 - 100}{100 - 50j + 100} = 0.24\angle -75.56$

$S = 1.64$

c) $\dfrac{50 + j10}{j5} = 0.6667 + j\,0.1383$, Daí temos que os máximos serão em $0.25\lambda - 0.02\lambda = 0.23\lambda$ e os mínimos em 0.021λ

d) $2.6686 \rightarrow$ 02 máximos, 03 mínimos $\Big\}$ $\dfrac{1}{Z_{in_3}} = (6.6667 - j\,2.362) \times 10^{-3}$

② $\underline{S = 3:1}$, V_{max} $0{,}5\lambda$

$z_L = 3 + j0$ em $0{,}25\lambda$, $V_L = 0{,}333 + j0$ em 0λ

Ponto de encontro do círculo S com o círculo $r = 1$: $1 + 1{,}15j$

$0.167\lambda - 0\lambda = \underline{0{,}167\lambda}$

Logo o comprimento do estube é:

$1 - j1.15 \rightarrow 0{,}333\lambda$

$d = 0.5\lambda - 0.333\lambda = 0.167\lambda$

③ $\alpha = 0$, $Z_0 = 75\Omega$, $l = 20m$, $f = 32 \times 10^6 Hz$, $Z_{in} = 30\Omega$

a) $Z_{in} = Z_0 \left[\dfrac{Z_L + j Z_0 \, tg(\beta l)}{Z_0 + j Z_L \, tg(\beta l)} \right] \Rightarrow 30 = 75 \cdot \left[\dfrac{Z_L + j75 \, tg(13.41)}{75 + jZ_L \, tg(13.41)} \right] = *$

$\beta = \dfrac{\omega}{v_p} \Rightarrow \dfrac{2\pi f}{\sqrt{\mu_0 \varepsilon_0}} = 0.67 \rightarrow \boxed{\beta l = 13.41}$

$* \Rightarrow Z_L = 55.96 - j58.44$

$\approx 56 - j58\,\Omega$

$z_L = 0.75 - 0.78j$

b) $Z_{in} = 75 + jX_{in}$, $X_{in} > 0$ e $X_{in} = ?$

$\boxed{z_{in} = 1 + j\dfrac{X_{in}}{75}}$ i) Ver onde o circulo S cruza o circulo R = 1, quando $X_{in} > 0$.

ii) Pela carta de Smith, temos:

$z'_{in} = 1 + 0.95j \rightarrow 0.16\lambda$ ($X_{in} > 0$)

$z''_{in} = 1 - 0.95j \rightarrow 0.34\lambda$ ($X_{in} < 0$) X

$z_L \Rightarrow 0.367\lambda$ { $d = 0.207\lambda \rightarrow D = 1.941\,m$

$\lambda = \dfrac{v}{f} = \dfrac{c}{f} = 9.375\,m$

$X_{in} = Z_0 \cdot x_{in} = \underline{71.25\,\Omega}$

(4)

$I_{min} - I_{max} = \frac{\lambda}{4} = 37.5\ cm - 12.5\ cm = 25cm \Rightarrow \lambda = 1\ m$

$v = f \cdot \lambda \Rightarrow f = \frac{3.10^8}{1} = 3 10^8\ Hz$

$\begin{cases} 0.5 & — 360 \\ 0.125 & — x \\ x = 90° \end{cases}$

na direção do gerador

$Z = Z_0 . Z_1$

$= (0.38 + 0.93j) 100$

$= 38 + 93j$

⑤ $H(z,t) = 2\cos(\omega t - \beta z)\,a_x + 6\cos(\omega t - \beta z + 120°)\,a_y$ A/m

$T = \frac{1}{f}$, $\omega = 2\pi f$

$\omega t = \frac{2\pi}{4} = \frac{\pi}{2}$

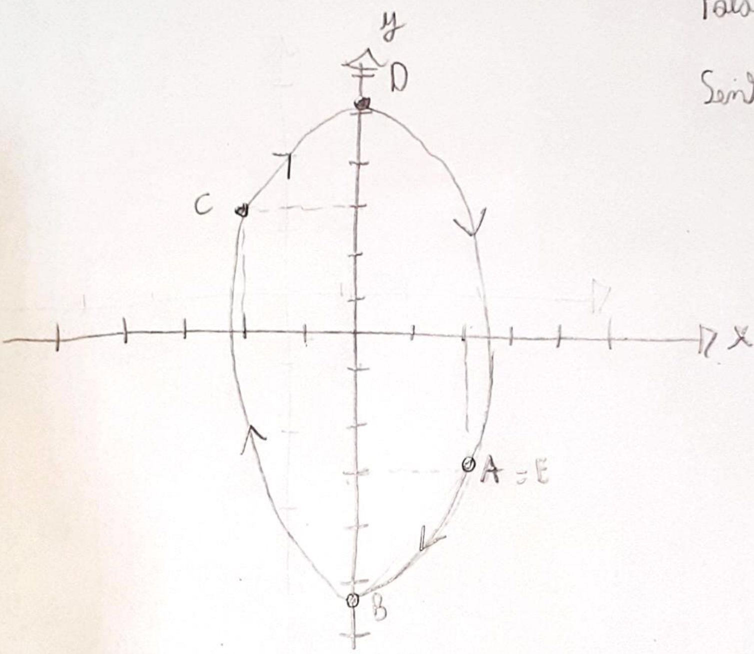
$A: (0,0) = 2\vec{a_x} + 6\cos(120)\vec{a_y} = 2\vec{a_x} - 3\vec{a_y}$

$B: (0,\frac{T}{4}) = 2\cos(\frac{\pi}{2})\vec{a_x} + 6\cos(\frac{\pi}{2}+120°)\vec{a_y} = 0\vec{a_x} - 3\sqrt{3}\vec{a_y}$

$C: (0,\frac{T}{2}) = 2\cos(\pi)\vec{a_x} + 6\cos(\pi+120)\vec{a_y} = -2\vec{a_x} + 3\vec{a_y}$

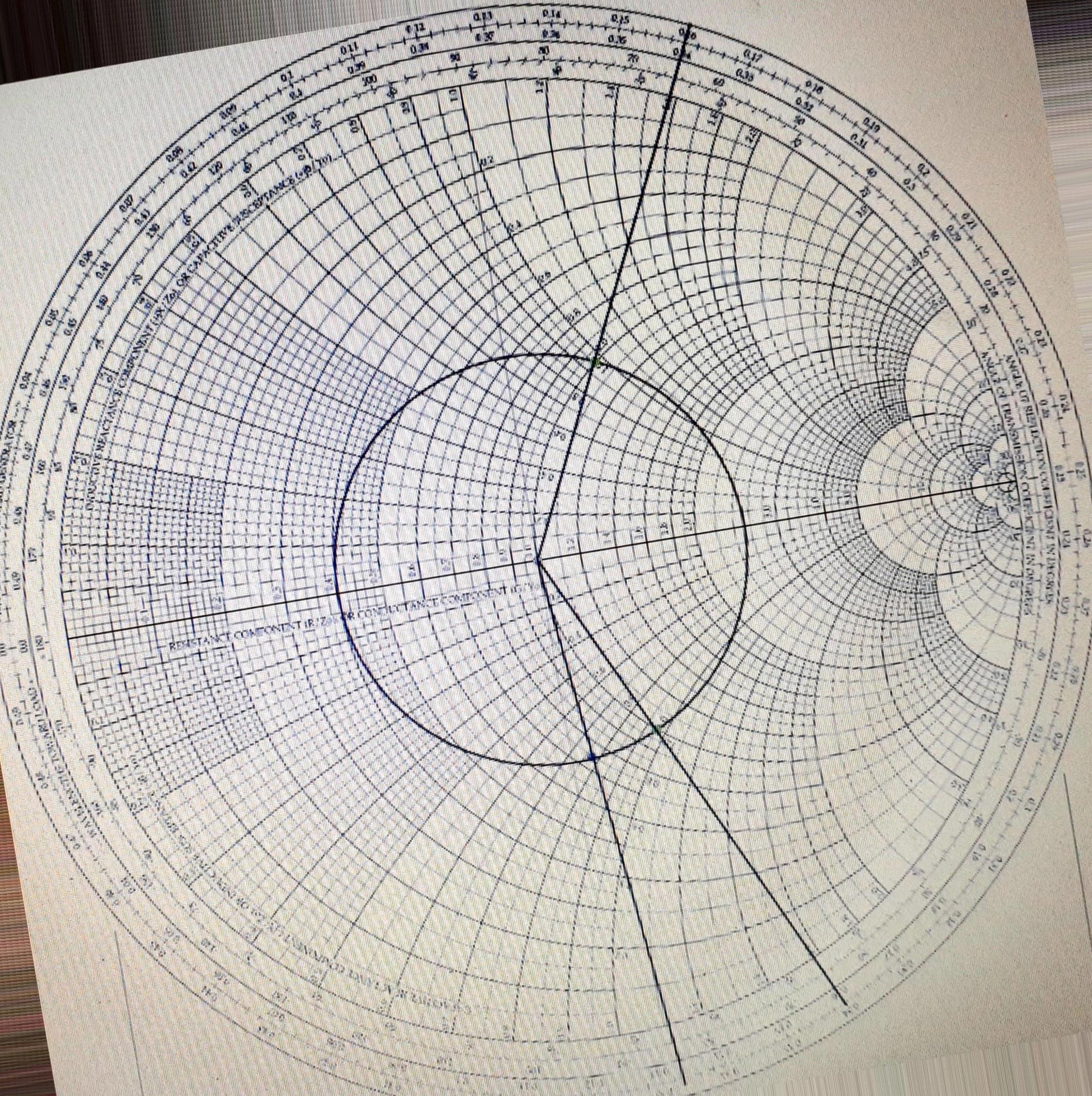
$D: (0,\frac{3T}{4}) = 2\cos(\frac{3\pi}{2})\vec{a_x} + 6\cos(\frac{3\pi}{2}+120)\vec{a_y} = 0\vec{a_x} + 3\sqrt{3}\vec{a_y}$

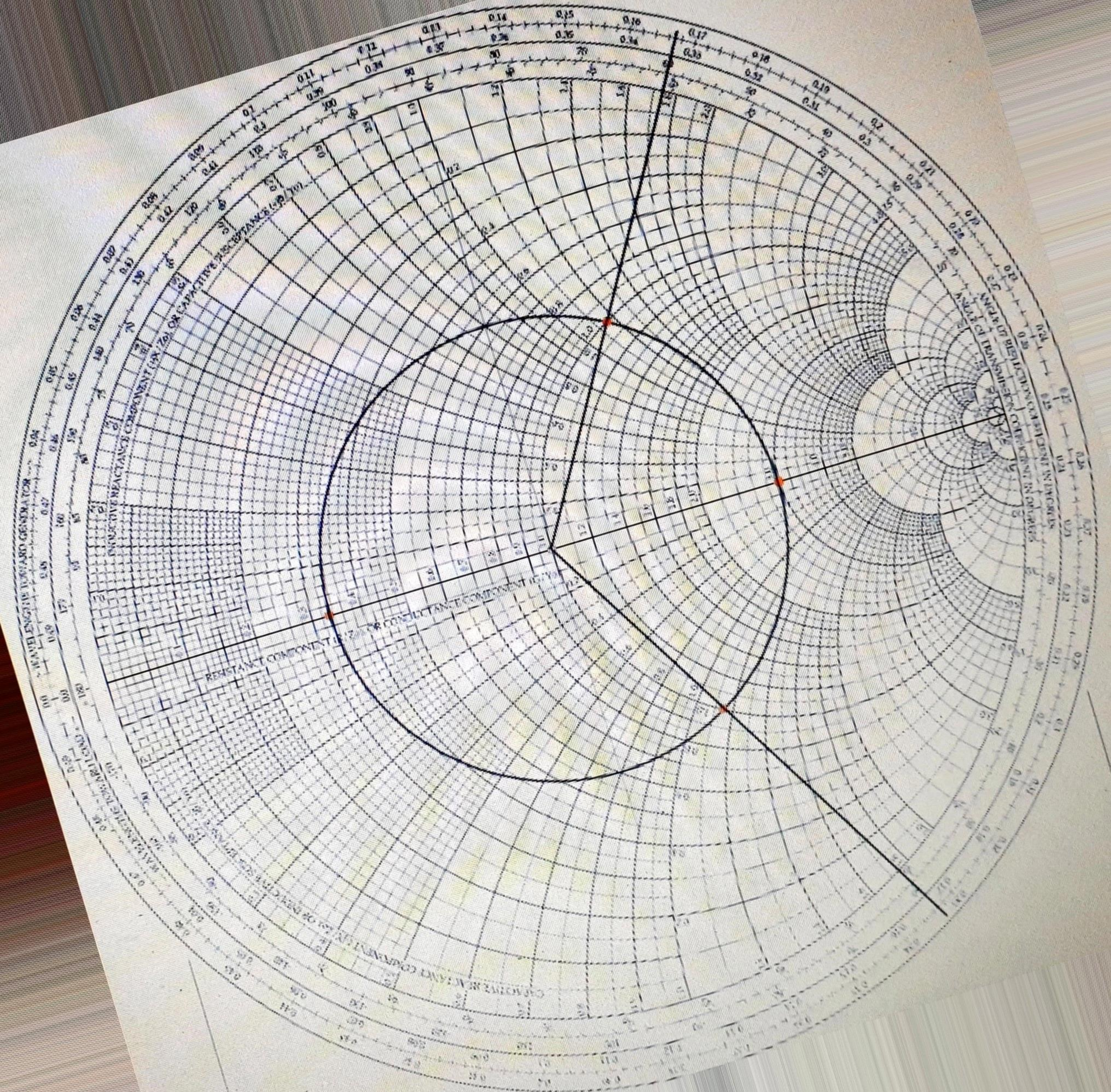
$E: (0,T) = 2\cos(2\pi)\vec{a_x} + 6\cos(2\pi+120)\vec{a_y} = 2\vec{a_x} - 3\vec{a_y}$



Polarização elíptica.

Sentido Horário.


RESISTANCE COMPONENT (R/Z0), OR CONDUCTANCE COMPONENT (G/Y0)
INDUCTIVE REACTANCE COMPONENT (+jX/Z0), OR CAPACITIVE SUSCEPTANCE (+jB/Y0)
WAVELENGTHS TOWARD GENERATOR
WAVELENGTHS TOWARD LOAD
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES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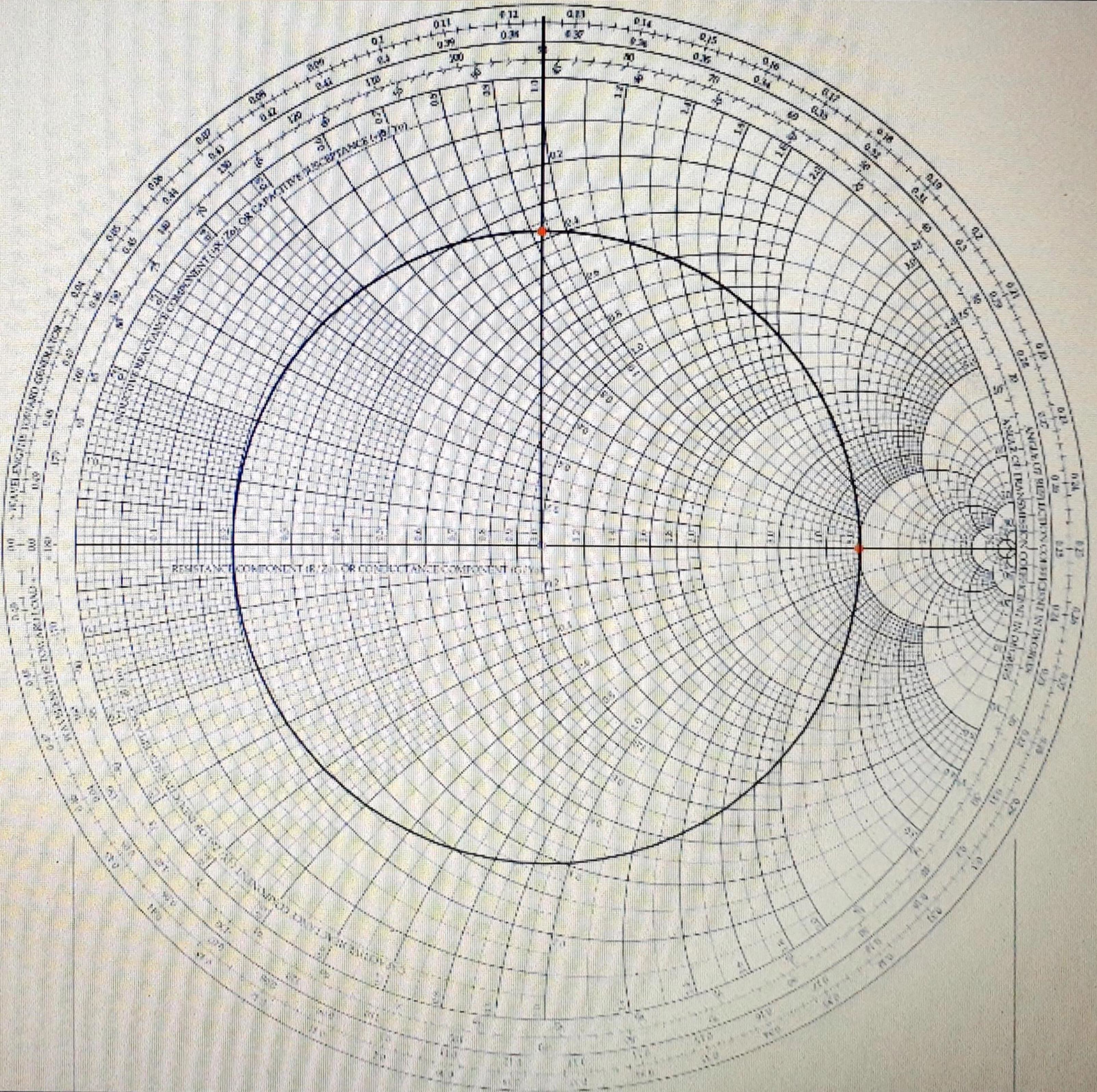

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