\(a_{-15^\circ}\) Continued:

\[ V(2) = \frac{V_0 \times R_0}{R_0 + R_g} e^{-(a+jb)2} = \frac{10 \times 50}{90 + 50} e^{-2(0.01 + j0.55)} \]

\[ I(2) = \frac{V(2)}{50} \]

\[ V(2,t) = 8.27 e^{-0.012} \sin(5000nt - 5.55x - 0.322) \]

\[ I(2,t) = 0.105 e^{-0.012} \sin(5000nt - 5.55x - 0.322) \]

\(b)\) at \(z = 50\ m\)

\[ V(50,t) = 8.17 \sin(5000nt - 277.922) \]

\[ I(50,t) = 0.0639 \sin(5000nt - 277.922) \]

\(c)\) \(P_{ov} = \frac{1}{2} \Re \left \{ V_c I_c^* \right \} = \frac{1}{2} \times 3.19 \times 0.0638 = 0.1017 \text{ (W)}\)

\(9.18\)

\[ \lambda = 2\ m \quad \omega_0 = 80\ \Omega \quad \omega_c = 40 + 150\ \xi \quad f = 2001 \text{ MHz} \]

\[ Z_L = \frac{R_0 \times R_c \tan(\theta)}{R_0 + R_c \tan(\theta)} \quad \beta_L = \frac{2nf}{c} = \frac{2 \times 1.38 \times 3 \times 10^8}{\lambda^2} \times \frac{3}{8} \]

\[ Z_L = \frac{80 \times (40 + 150)}{80 + j(40 + 150) \tan(\theta)} = 26.8245 - 9.1709\ j \]

\(2)\)
\( q-20 \) \( \lambda = 0.6 \text{m} \quad f = 100 \text{kHz} \quad C = 54 \text{pF} \)

a) short circuit: \( j \omega L = j \omega L = \tan (\lambda) \)

open circuit: \( \frac{1}{j \omega C} = -j \frac{2\pi}{\tan (\lambda)} \)

\( \frac{L}{C} = \frac{1}{\omega^2} \quad \Rightarrow \quad L = 74.5 \Omega \)

\( \mu \epsilon = L \quad \Rightarrow \quad \epsilon_r = \frac{L}{\mu \epsilon} = 4.05 \)

b) \( \beta = \tan^{-1} \left( \frac{\omega L}{\omega C} \right) = 0.84^\circ \)

\( \gamma_0 = -R_0 \tan (\beta) = -\frac{1}{\omega L} = -290 \Omega \)

\( \gamma_c = R_0 \tan (\beta) = 290 \Omega = 19.2 \Omega \)

\( q-49 \)

\[ \begin{align*}
Z_L &= 25 + 25 \text{j} \Omega \\
R_0 &= 50 \Omega \\
\beta &= 35 \text{j} \Omega \\
\end{align*} \]

\[ \begin{align*}
\lambda_c &= \frac{Z_L}{R_0} = \frac{1}{2} + \frac{1}{2} \text{j} \\
\lambda_c &= 25 + 25 \text{j} \Omega \quad R_0 = 50 \Omega \\
\beta &= 35 \text{j} \Omega \\
\end{align*} \]

From Smith chart, moving \( \lambda_c \) to \( \lambda_c \) : \( d = (0.182 - 0.026) \lambda = 0.0155 \lambda \)

To get match for \( \frac{50}{R_0} = 1.43 \) from Smith chart, we get

\( \lambda = 0.347 \lambda \)
This problem can be treated like the parallel single stub problems, with the difference that we use Smith chart as an impedance chart so the point $P_a$ would be on the left side of the chart.

One may note you have just added to the length of the line so we don’t have a short stub in series, but we have to note if you look from here into the stub, the equivalent $Z_{in}$ is like a transmission line itself terminated with short circuit (which has imaginary values)

$$R_o = Z_{in} + jZ_b$$

and

$$1 = \frac{Z_{in}}{Z_o} + \frac{Z_b}{Z_o}$$

again like parallel stub we see since $Z_{in}$ is purely imaginary $Z_b$ should be:

$$Z_b = 1 + j\frac{Z_o}{Z_e}$$

so find the location of normalized $\frac{Z_e}{Z_o} = Z_e = 0.5 + j0.5$ on Smith chart (attached)

we draw a circle $R = 1$ and it cuts circle of $R = 1$ at two points (since $Z_e = 1 + jZ_e$)

$P_1: 1 + j1$ $P_2: 1 - j1$

we go from $P_1$ to $P_2$ (for stub to load) and read wavelength

$$\frac{d_1}{\lambda} = (0.162 - 0.088) = 0.074$$

the same way for $P_2$:

$$\frac{d_2}{\lambda} = (0.334 - 0.088) = 0.25$$
P. 9.49) continue.

Next calculate $\lambda$.

For $\underline{\gamma_i}$: $\lambda \rightarrow \lambda$ should give $\underline{\nu} = -j\lambda$.

For short circuit we have:

\[ Z_{\infty} = \frac{Z_0 e^{j\phi}}{R_0 e^{j\phi}} \quad z_{\infty} = Z_{\infty} = j R_0 \tan \phi \]

Normalized: $-j x \Rightarrow -30j = j R_0 \tan \phi \Rightarrow \frac{-30j}{30j} = -1.43j = j \tan \phi$

So now on smith chart we find $x = 1.43$ for $\nu_2$

the same way for $\nu_3 x \approx 1.43$

$\Rightarrow$ from $\nu_3$ to $\nu_4$: $\frac{\nu_4}{\nu_3} = 0.347$

from $\nu_3$ to $\nu_5$: $\frac{\nu_5}{\nu_3} = 0.13$
The Complete Smith Chart
Black Magic Design