

## Parameters for Problem 5c

$$j := \sqrt{-1} \quad \text{dB} := 1$$

$$M := \begin{bmatrix} 0.53 & 0.09 \\ 2.93 & 0.40 \end{bmatrix} \quad \phi := \begin{bmatrix} 178 \cdot \text{deg} & 48.0 \cdot \text{deg} \\ 76.0 \cdot \text{deg} & -56.0 \cdot \text{deg} \end{bmatrix} \quad m := 1..2 \quad n := 1..2 \quad S_{m,n} := M_{m,n} \cdot e^{j \cdot (\phi_{m,n} \cdot \text{rad})}$$

$$\Delta := S_{1,1} \cdot S_{2,2} - S_{2,1} \cdot S_{1,2} \quad |\Delta| = 5.235 \cdot 10^{-2} \quad \arg(\Delta) = -4.788 \cdot 10^1 \cdot \text{deg}$$

$$K := \left[ \frac{1 - (|S_{1,1}|)^2 - (|S_{2,2}|)^2 + (|\Delta|)^2}{2 \cdot |S_{1,2} \cdot S_{2,1}|} \right] \quad K = 1.065$$

$$B_1 := 1 + (|S_{1,1}|)^2 - (|S_{2,2}|)^2 - (|\Delta|)^2 \quad B_1 = 1.118 \quad B_2 := 1 + (|S_{2,2}|)^2 - (|S_{1,1}|)^2 - (|\Delta|)^2 \quad B_2 = 8.764 \cdot 10^{-1}$$

$$C_1 := S_{1,1} - \Delta \cdot \overline{S_{2,2}} \quad C_1 = -5.504 \cdot 10^{-1} + 1.554j \cdot 10^{-2} \quad C_2 := S_{2,2} - \Delta \cdot \overline{S_{1,1}} \quad C_2 = 2.43 \cdot 10^{-1} - 3.515j \cdot 10^{-1}$$

$$\Gamma_{Ms} := \frac{B_1 - \sqrt{[B_1^2 - 4 \cdot (|C_1|)^2]}}{2 \cdot C_1} \quad \Gamma_s := \Gamma_{Ms} \quad \Gamma_{out} := S_{2,2} + \frac{S_{1,2} \cdot S_{2,1} \cdot \Gamma_s}{1 - S_{1,1} \cdot \Gamma_s} \quad \Gamma_{ML} := \frac{B_2 - \sqrt{[B_2^2 - 4 \cdot (|C_2|)^2]}}{2 \cdot C_2} \quad \Gamma_L := \Gamma_{ML}$$

$$\Gamma_{in} := S_{1,1} + \frac{S_{1,2} \cdot S_{2,1} \cdot \Gamma_L}{1 - S_{2,2} \cdot \Gamma_L} \quad \text{Mag}_{\Gamma a} := \left| \frac{\Gamma_{in} - \overline{\Gamma_s}}{1 - \Gamma_{in} \cdot \Gamma_s} \right| \quad \text{VSWR}_{in} := \frac{1 + \text{Mag}_{\Gamma a}}{1 - \text{Mag}_{\Gamma a}} \quad \text{Mag}_{\Gamma b} := \left| \frac{\Gamma_{out} - \overline{\Gamma_L}}{1 - \Gamma_{out} \cdot \Gamma_L} \right| \quad \text{VSWR}_{out} := \frac{1 + \text{Mag}_{\Gamma b}}{1 - \text{Mag}_{\Gamma b}}$$

Answers for Problem 5c

$$G_T := \left[ \frac{1 - |\Gamma_s|^2}{|1 - \Gamma_{in} \Gamma_s|^2} \right] \cdot |S_{2,1}|^2 \cdot \left[ \frac{1 - |\Gamma_L|^2}{|1 - S_{2,2} \Gamma_L|^2} \right]$$

$$G_{T\_dB} := 10 \cdot \log(G_T)$$

$$G_T = 2.273 \cdot 10^1$$

$$G_{T\_dB} = 1.357 \cdot 10^1 \text{ dB}$$

$$G_P := \left[ \frac{1}{|1 - |\Gamma_{in}|^2|} \right] \cdot |S_{2,1}|^2 \cdot \left[ \frac{1 - |\Gamma_L|^2}{|1 - S_{2,2} \Gamma_L|^2} \right]$$

$$G_{P\_dB} := 10 \cdot \log(G_P)$$

$$G_P = 2.273 \cdot 10^1$$

$$G_{P\_dB} = 1.357 \cdot 10^1 \text{ dB}$$

$$G_A := \left[ \frac{1 - |\Gamma_s|^2}{|1 - S_{1,1} \Gamma_s|^2} \right] \cdot |S_{2,1}|^2 \cdot \left[ \frac{1}{|1 - |\Gamma_{out}|^2|} \right]$$

$$G_{A\_dB} := 10 \cdot \log(G_A)$$

$$G_A = 2.273 \cdot 10^1$$

$$G_{A\_dB} = 1.357 \cdot 10^1 \text{ dB}$$

$$|\Gamma_s| = 8.395 \cdot 10^{-1} \quad \arg(\Gamma_s) = -1.784 \cdot 10^2 \text{ deg}$$

$$\Gamma_s = -8.391 \cdot 10^{-1} - 2.369j \cdot 10^{-2}$$

$$\text{Mag}_{\Gamma_a} = 2.256 \cdot 10^{-15}$$

$$|\Gamma_{in}| = 8.395 \cdot 10^{-1} \quad \arg(\Gamma_{in}) = 1.784 \cdot 10^2 \text{ deg}$$

$$\Gamma_{in} = -8.391 \cdot 10^{-1} + 2.369j \cdot 10^{-2}$$

$$\text{VSWR}_{in} = 1$$

$$|\Gamma_L| = 7.987 \cdot 10^{-1} \quad \arg(\Gamma_L) = 5.535 \cdot 10^1 \text{ deg}$$

$$\Gamma_L = 4.542 \cdot 10^{-1} + 6.57j \cdot 10^{-1}$$

$$\text{Mag}_{\Gamma_b} = 1.788 \cdot 10^{-15}$$

$$|\Gamma_{out}| = 7.987 \cdot 10^{-1} \quad \arg(\Gamma_{out}) = -5.535 \cdot 10^1 \text{ deg}$$

$$\Gamma_{out} = 4.542 \cdot 10^{-1} - 6.57j \cdot 10^{-1}$$

$$\text{VSWR}_{out} = 1$$