

Dik:  $Z_0 = Z_{01} = Z_{02} = 50 \Omega$

$$Z_s = 20 \Omega$$

$$Z_L = 30 \Omega$$

$$S_{11} = 0,45 \angle 150^\circ$$

$$S_{12} = 0,01 \angle -10^\circ$$

$$S_{21} = 2,05 \angle 10^\circ$$

$$S_{22} = 0,40 \angle -150^\circ$$

Dit:  $G_p = \dots ?$

$$G_A = \dots ?$$

$$G_T = \dots ?$$

Jawab:

# Cari  $\Gamma_s$  dan  $\Gamma_L$

$$\Gamma_s = \frac{Z_s - Z_{01}}{Z_s + Z_{01}} = \frac{Z_s - Z_0}{Z_s + Z_0} = \frac{20 - 50}{20 + 50} = \frac{-30}{70} = -0,4285 \dots$$

$$\Gamma_s \approx -0,429$$

$$\Gamma_L = \frac{Z_L - Z_{02}}{Z_L + Z_{02}} = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{30 - 50}{30 + 50} = \frac{-20}{80} = -0,250$$

# Ubah parameter S ke bentuk bil. kompleks

$$S_{11} = 0,45 \angle 150^\circ \rightarrow S_{11} = 0,45 (\cos 150^\circ + j \sin 150^\circ)$$

$$S_{11} = -0,390 + j 0,225$$

$$S_{12} = 0,01 \angle -10^\circ \rightarrow S_{12} = 0,01 (\cos(-10^\circ) + j \sin(-10^\circ))$$

$$= 0,01 - j 0,001$$

$$S_{21} = 2,05 \angle 10^\circ \rightarrow S_{21} = 2,05 (\cos 10^\circ + j \sin 10^\circ)$$

$$S_{21} = 2,019 + j 0,356$$

$$S_{22} = 0,40 \angle -150^\circ \rightarrow S_{22} = 0,40 (\cos(-150^\circ) + j \sin(-150^\circ))$$

$$S_{22} = -0,35 - j 0,2$$

# Cari nilai  $\Gamma_{in}$  dan  $\Gamma_{out}$

$$\Gamma_{in} = S_{11} + \frac{S_{12} \cdot S_{21} \cdot \Gamma_L}{1 - S_{22} \cdot \Gamma_L}$$

$$= (-0,39 + j 0,225) + \frac{(0,01 - j 0,001) \cdot (2,019 + j 0,356) \cdot (-0,25)}{1 - (-0,35 - j 0,2) \cdot (-0,25)}$$

$$= -0,39 + j 0,225 + \frac{(0,02 + j 0,01)(-0,25)}{1 - (0,0875 + j 0,05)}$$

$$= -0,39 + j 0,225 + \frac{-0,005 + j 0,0025}{0,9125 - j 0,05}$$

$$= -0,39 + j 0,225 + \frac{-2 + j}{365 - j 20} \times \frac{365 + j 20}{365 + j 20}$$

$$= -0,39 + j 0,225 + \frac{-750 + j 325}{365^2 + 20^2}$$

$$= -0,39 + j 0,225 + (-0,0056 + j 0,0024)$$

$$= -0,3956 + j 0,2274$$

$$= \sqrt{(-0,3956)^2 + (0,2274)^2} \angle \tan^{-1} \left( \frac{0,2274}{-0,3956} \right)$$

$$= 0,456 \angle -30^\circ = 0,456 \angle 150^\circ$$

$$\Gamma_{out} = S_{22} + \frac{S_{12} \cdot S_{21} \cdot \Gamma_s}{1 - S_{11} \cdot \Gamma_s}$$

$$= (-0,35 - j 0,2) + \frac{(0,01 + j 0,001)(2,019 + j 0,356)(-0,429)}{1 - (-0,39 + j 0,225)(-0,429)}$$

$$= -0,35 - j0,2 + \frac{(0,02 + j0,01)(-0,429)}{1 - (0,167 - j0,096)}$$

$$= -0,35 - j0,2 + \frac{-0,009 - j0,004}{0,133 + j0,096} \times \frac{0,833 - j0,096}{0,133 - j0,096}$$

$$= -0,35 - j0,2 + \frac{-0,008 - j0,0025}{0,133^2 + 0,096^2}$$

$$= -0,35 - j0,2 + (-0,0114 - j0,0036)$$

$$= -0,361 - j0,2036$$

$$= \sqrt{(-0,361)^2 + (-0,2036)^2} \angle \tan^{-1} \left( \frac{-0,2036}{-0,361} \right)$$

$$= 0,414 \angle 29^\circ = 0,414 \angle -151^\circ$$

# Cari  $G_P$ ,  $G_A$ ,  $G_T$

$$G_P = \frac{1}{1 - |\Gamma_{in}|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - S_{22} \cdot \Gamma_L|^2}$$

$$= \frac{1}{1 - 0,456^2} (2,05)^2 \frac{1 - (-0,25)^2}{|1 - (-0,35 - j0,2)(-0,25)|^2}$$

$$= 1,26 \cdot 4,2025 \cdot \frac{1 - 0,0625}{|0,0125 - j0,05|^2}$$

$$= 5,295 \cdot \frac{0,9375}{0,0351}$$

$$G_P = \underline{\underline{5,944}}$$

$$G_A = \frac{1 - |\Gamma_s|^2}{|1 - S_{11} \cdot \Gamma_s|^2} |S_{21}|^2 \frac{1}{1 - |\Gamma_{out}|^2}$$

$$= \frac{1 - (-0,429)^2}{|1 - (-0,39 + j0,225)(-0,429)|^2} \cdot (2,05)^2 \cdot \frac{1}{1 - (0,414)^2}$$

$$= \frac{0,816}{|0,833 + j0,096|^2} \cdot 4,2025 \cdot \frac{1}{0,829}$$

$$G_A = 5,883$$

$$G_T = \frac{1 - |\Gamma_S|^2}{|1 - S_{11} \cdot \Gamma_S|^2} \cdot |S_{21}|^2 \cdot \frac{1 - |\Gamma_L|^2}{|1 - \Gamma_{out} \cdot \Gamma_L|^2}$$

$$= \frac{1 - (-0,429)^2}{|1 - (-0,39 + j0,225)(-0,429)|^2} \cdot (2,05)^2 \cdot \frac{1 - (-0,25)^2}{|1 - (-0,361 - j0,2036)(-0,25)|^2}$$

$$= \frac{0,816}{|0,833 + j0,096|^2} \cdot 4,2025 \cdot \frac{0,9375}{|0,90975 - j0,0509|^2}$$

$$G_T = 5,507$$