นายโสภณ สุขสมบูรณ์
6201063988 sec. 1
Comm Cir Design. (WPK)

Quiz 3

Find Z-parameters of the BJT transistor that has S-parameters at 1.5 GHz as

$S_{11} = 0.6 \angle -127^\circ$ $\quad S_{12} = 0.039 \angle 28^\circ$

$S_{21} = 3.88 \angle 87^\circ$ $\quad S_{22} = 0.76 \angle -35^\circ$

Formula : S-parameters transform Z-parameters.

$$z_{11} = z_0 \cdot \frac{(1+s_{11})(1-s_{22}) + s_{12}s_{21}}{(1-s_{11})(1-s_{22}) - s_{12}s_{21}} \quad \text{---------- (1)}$$

$$= 50 \, \frac{(1+0.6\angle -127^\circ)(1-0.76\angle -35^\circ) + (0.039\angle 28^\circ)(3.88\angle 87^\circ)}{(1-0.6\angle -127^\circ)(1-0.76\angle -35^\circ) - (0.039\angle 28^\circ)(3.88\angle 87^\circ)}$$

EQN ; $z_{11} = 30.694\angle -28.627^\circ$ ✱

$$z_{12} = z_0 \cdot \frac{2s_{12}}{(1-s_{11})(1-s_{22}) - s_{12}s_{21}} \quad \text{---------- (2)}$$

; $z_{12} = 50 \cdot \frac{2(0.039\angle 28^\circ)}{(1-0.6\angle -127^\circ)(1-0.76\angle -35^\circ) - (0.039\angle 28^\circ)(3.88\angle 87^\circ)}$

EQN ; $z_{12} = 5.2982\angle -31.93^\circ$ ✱

$$z_{21} = z_0 \cdot \frac{2s_{22}}{(1-s_{11})(1-s_{22}) - s_{12}s_{21}} \quad \text{---------- (3)}$$

; $z_{21} = 50 \cdot \frac{2(0.76\angle -35^\circ)}{(1-0.6\angle -127^\circ)(1-0.76\angle -35^\circ) - (0.039\angle 28^\circ)(3.88\angle 87^\circ)}$

EQN ; $z_{21} = 527.103\angle 27.067^\circ$ ✱

$$z_{22} = z_0 \cdot \frac{(1-s_{11})(1+s_{22}) + s_{12}s_{21}}{(1-s_{11})(1-s_{22}) - s_{12}s_{21}} \quad \text{---------- (4)}$$

; $z_{22} = 50 \cdot \frac{(1-0.6\angle -127^\circ)(1+0.76\angle -35^\circ) + (0.039\angle 28^\circ)(3.88\angle 87^\circ)}{(1-0.6\angle -127^\circ)(1-0.76\angle -35^\circ) - (0.039\angle 28^\circ)(3.88\angle 87^\circ)}$

EQN ; $z_{22} = 161.837\angle -57.158^\circ$ ✱

Hence, z-parameters is

$$z = \begin{bmatrix} 30.694\angle -26.627^\circ & 5.2982\angle -31.93^\circ \\ 527.103\angle 27.067^\circ & 161.337\angle -57.158^\circ \end{bmatrix}$$