1 Gains

Transducer power gain G_T:

$$G_T = \frac{\text{power out of circuit}}{\text{maximum power in}}$$

Available power gain G_a:

$$G_a = \frac{\text{maximum power out}}{\text{maximum power in}}$$

Power gain G_p, also called the operating power gain:

$$G_p = \frac{\text{power out of circuit}}{\text{power into circuit}}$$

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$$G_T = \frac{1 - |\Gamma_G|^2}{|1 - \Gamma_{\text{in}}\Gamma_G|^2} |S_{21}|^2 \frac{1 - |\Gamma_L|^2}{|1 - S_{22}\Gamma_L|^2}$$

$$G_a = \frac{1 - |\Gamma_G|^2}{|1 - S_{11}\Gamma_G|^2} |S_{21}|^2 \frac{1}{1 - |\Gamma_{\text{out}}|^2}$$

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

$$\Gamma_{\text{in}} = \frac{Z_{\text{in}} - Z_0}{Z_{\text{in}} + Z_0}$$

$$\Gamma_{\text{out}} = \frac{Z_{\text{out}} - Z_0}{Z_{\text{out}} + Z_0}$$

$$\Gamma_G = \frac{Z_G - Z_0}{Z_G + Z_0}$$

$$\Gamma_L = \frac{Z_L - Z_0}{Z_L + Z_0}$$

Z_0 . . . reference impedance

2 Stability

Mu-factor:

$$\mu = \frac{1 - |S_{11}|^2}{|S_{11}{}^* \Delta - S_{22}| + |S_{12}S_{21}|} > 1$$

Rollett-Kurokawa factor:

$$K = \frac{1 - |S_{11}|^2 - |S_{22}|^2 + |\Delta|^2}{2\,|S_{12}|\,|S_{21}|} > 1 \quad \text{(assuming } |\Delta| < 1\text{)}$$

—

$$\Delta = S_{11}S_{22} - S_{12}S_{21}$$