TCET Formula Sheet

Decibel Formulas

Relative Power Gain

$$A_P = \frac{P_O}{P_I}$$

where P_O and P_I are defined as the following:

$$P_I = \frac{V_I^2}{R_I}$$

$$P_O = \frac{V_O^2}{R_O}$$

Relative Voltage Gain

$$A_V = \frac{V_O}{V_I}$$

Relative Power Gain in dB

$$A_P(db) = 10\log_{10} A_P$$

Given that $R_O = R_I$

If $R_O \neq R_I$ then the general form is given by the following:

$$A_P(db) = 10\log_{10}\left(\frac{\frac{V_O^2}{R_O}}{\frac{V_I^2}{R_I}}\right)$$

Relative Voltage Gain in dB

$$A_V(db) = 20\log_{10}\left(\frac{V_O}{V_I}\right) = 20\log_{10} A_V$$

If $R_O \neq R_I$ then the general form is given by the following:

$$A_V(db) = 20\log_{10}\left(\frac{V_O}{V_I}\right) - 10\log_{10}\left(\frac{R_O}{R_I}\right)$$

Absolute Power Gain dBm

$$A_{P(dBm)} = 10\log_{10}\left(\frac{P}{1\text{ mW}}\right),\ \text{dBm}$$

Absolute Power Gain dBw

$$A_{P(dBw)} = 10\log_{10}\left(\frac{P}{1\text{ W}}\right),\ \text{dBw}$$

Signal-to-Noise Ratio

$$\text{SNR} = 10\log_{10}\left(\frac{\text{Signal Power}}{\text{Noise Power}}\right)$$

And given that $R_O = R_I$,

$$\text{SNR} = 10\log_{10}\left(\frac{V_S^2}{V_N^2}\right)$$

$$\text{SNR} = 20\log_{10}\left(\frac{V_S}{V_N}\right)\text{dB}$$

Impulse Noise

$$dB_S = 20\log_{10}\left(\frac{P}{0.0002\bar{\mu}}\right),\ \text{where P is sound pressure in } \bar{\mu}$$

$$\bar{\mu} = 1\frac{\text{dyne}}{\text{cm}^2} = 10^{-6} \text{ of atmospheric pressure at sea level}$$

Impedance Matching

$$R_S = R_L,\ \text{for DC sources.}$$

$$Z_S = Z_L,\ \text{for AC sources.}$$

Source Resistance = Load Resistance

$$P_I = P_O$$

Key Points L-Pad Networks

1. The primary applications of L-networks involve impedance matching in RF circuits, transmitters, and receivers.
2. L-networks are useful in matching one amplifier output to the input of a following stage.
3. Any RF circuit application covering a narrow frequency range is a candidate for an L-network.
4. There are four basic versions of the L-network, with two low-pass versions and two high-pass versions.
5. Most widely used since they attenuate harmonics, noise, and other undesired signals.
6. The impedances that are being matched determine the Q (quality factor) of the circuit, which cannot be specified or controlled.**
7. There are limits to the range of impedances that it can match.**

Key Points Pi-Pad Networks

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L-Pad Formulas (Low Pass 1)

$$Q = \sqrt{\frac{R_L}{R_S} - 1}$$

$$X_L = QR_S$$

$$L = \frac{X_L}{2\pi f}$$

$$X_C = \frac{R_L}{Q}$$

$$C = \frac{1}{2\pi f X_C}$$

$$BW = \frac{f}{Q}$$

L-Pad Formulas (Low Pass 2)

$$Q = \sqrt{\frac{R_L}{R_S} - 1}$$

$$X_L = QR_S$$

$$L = \frac{X_L}{2\pi f}$$

$$X_C = \frac{R_L}{Q}$$

$$C = \frac{1}{2\pi f X_C}$$

$$BW = \frac{f}{Q}$$

Resonance

Etc.

Telecommunications (Chapter 11)

Etc.