Effects of Electrical Noise on Biomedical Electronics

指導教授 : 洪崇智教授
組員：王立揚 羅芳毅

- The electrical noise coming out of a circuit can be measured using a SA, as seen in Fig.
- If the noise coming out of a CUT is lower than the noise floor of the SA, a low-noise amplifier (LNA) is inserted between the CUT and SA to help with the noise measurement
- We generally plot PSD versus frequency to ultimately characterize the power in a signal or the signal's RMS value.

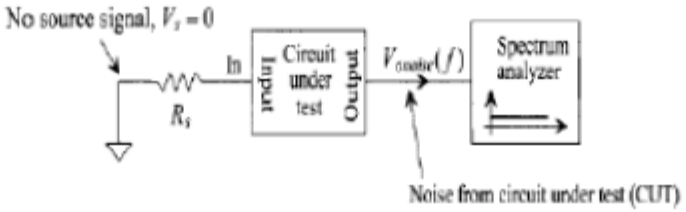


Figure 8.6 Circuit used for noise measurement.

Calculating and Modeling Circuit Noise

- If this noise signal's PSD is calle$V^2_{noise}(f)$ (units, V^2/Hz) ,we can determine its RMS value

$$V_{RMS} = \sqrt{\int_{f_L}^{f_H} V^2_{noise}(f) \cdot df} \qquad \text{Volts}$$

- If the noise PSD is flat

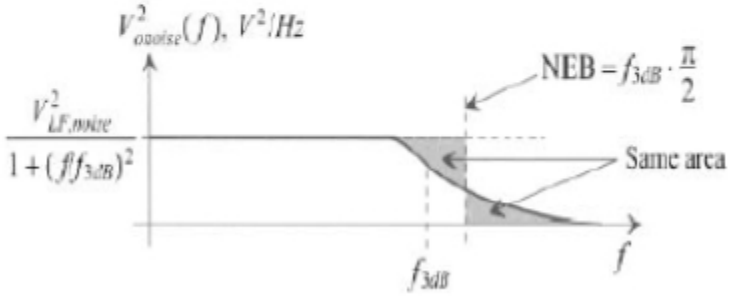
$$V_{RMS} = \sqrt{(f_H - f_L) \cdot V^2_{noise}(f)}$$

Noise Equivalent Bandwidth

- In real circuits the signals, and noise, are bandlimited
- This bandlimiting can be the result of intentionally added or parasitic

  capacitances present in the circuit.
- Figure shows a noise spectrum if the CUT shows a simple

  single-pole roll-off.



Signal-to-Noise Ratio

- Definition: $$SNR = \frac{\text{desired signal power, } P_s}{\text{undesired signal power (noise), } P_{noise}}$$

- Using dB: $$SNR = 10 \log \frac{P_s}{P_{noise}}$$