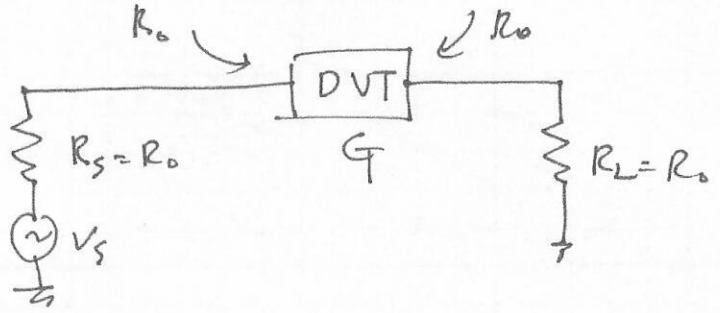
NF Measurement (1)



- step 1) $V_S = 0$

$\Rightarrow$ output noise power ($= P_{on}$)

$$P_{on} = kT\Delta f \cdot G + \underbrace{\text{DUT noise power}}_{P_{on,DUT}}$$

$$= kT\Delta f \cdot G + P_{on,DUT}$$

- step 2) Increase V_S until outpower becomes $2P_{on}$.

$$\Rightarrow 2P_{on} = \underbrace{\frac{V_s^2}{4R_o} \cdot G}_{\text{output power due to applied source, } V_S} + \underbrace{kT\Delta f\, G}_{\text{output power due to noise in } R_S} + \underbrace{P_{on,out}}_{\text{DUT output noise power}}$$

$$= \frac{V_s^2}{4R_o} G + P_{on}$$

$$\therefore P_{on} = \frac{V_s^2}{4R_o} G \Rightarrow P_{on,DUT} = P_{on} - kT\Delta f \cdot G$$

$$= \frac{V_s^2}{4R_o} G - kT\Delta f\, G$$

From step-1) and step-2),

$$F = 1 + \frac{P_{on,out}}{kT\Delta f \cdot G} = \frac{\frac{V_s^2}{4R_o} \cdot G}{kT\Delta f \cdot G} = \frac{\frac{V_s^2}{4R_o}}{kT\Delta f}$$

Note: you need to know Δf in this method.