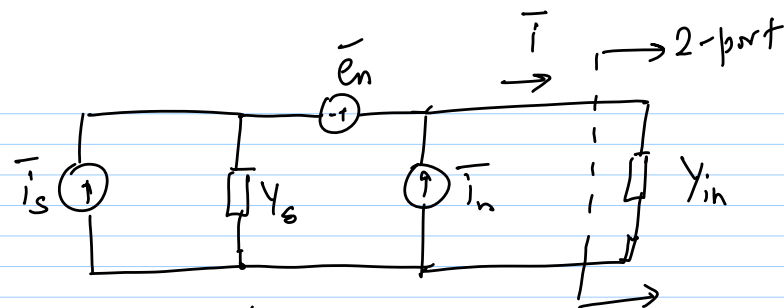
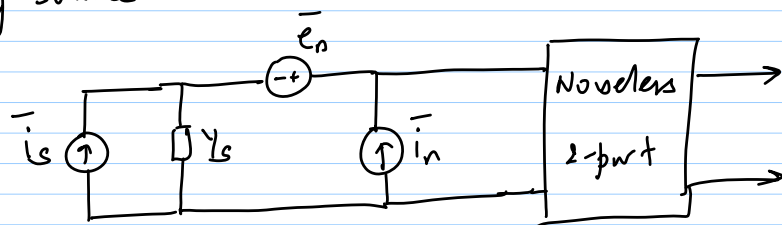
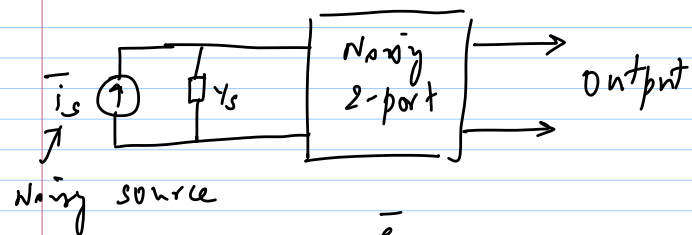


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Lec 12



$$\bar{i} = \bar{i}_s \left(\frac{Y_{in}}{Y_s + Y_{in}} \right) + (\bar{i}_n + \bar{e}_n Y_s) \left(\frac{Y_{in}}{Y_{in} + Y_s} \right)$$

$$F = \frac{\bar{i}_s^2 \left(\frac{Y_{in}}{Y_s + Y_{in}} \right)^2 + |\bar{i}_n + \bar{e}_n Y_s|^2 \cdot \left(\frac{Y_{in}}{Y_{in} + Y_s} \right)^2}{\bar{i}_s^2 \left(\frac{Y_{in}}{Y_s + Y_{in}} \right)^2}$$

$$= 1 + \frac{|\bar{i}_n + \bar{e}_n Y_s|^2}{\bar{i}_s^2}$$

$$\bar{i}_n = \underbrace{\bar{i}_c}_{\text{correlated with } \bar{e}_n} + \underbrace{\bar{i}_u}_{\text{uncorrelated with } \bar{e}_n}$$

$$\bar{i}_c = Y_c \cdot \bar{e}_n$$

$$F = 1 + \frac{|\bar{i}_u + (Y_c + Y_s) \bar{e}_n|^2}{\bar{i}_s^2}$$

$$= 1 + \frac{\bar{i}_u^2 + |Y_c + Y_s|^2 \cdot \bar{e}_n^2}{\bar{i}_s^2}$$

$$R_n \equiv \frac{\bar{e}_n^2}{4kT\Delta f}$$

$$G_u \equiv \frac{\bar{i}_u^2}{4kT\Delta f}$$

$$G_s \equiv \frac{\bar{i}_s^2}{4kT\Delta f}$$

$$\Rightarrow F = 1 + \frac{G_u + |Y_c + Y_s|^2 \cdot R_N}{G_s}$$

$$Y_c = G_c + jB_c ; Y_s = G_s + jB_s$$

$$F = 1 + \frac{G_u + [(G_c + G_s)^2 + (B_c + B_s)^2] \cdot R_N}{G_s}$$

$$\overset{F_{\min}}{1) \frac{\partial F}{\partial B_s} = 0} \Rightarrow \boxed{B_c = -B_s = B_{\text{opt}}}$$

$$\boxed{G_s = \sqrt{\frac{G_u}{R_N} + G_c^2} = G_{\text{opt}}}$$

$$F_{\min} = 1 + \frac{G_u + [(G_c + G_{\text{opt}})^2 + (B_c + B_{\text{opt}})^2] R_N}{G_{\text{opt}}}$$

$$G_u = (G_{\text{opt}}^2 - G_c^2) \cdot R_N$$

$$\therefore \boxed{F_{\min} = 1 + 2 R_N (G_{\text{opt}} + G_c)}$$

$$2) \frac{\partial F}{\partial G_s} = 0$$

$$F = 1 + \frac{G_u + (G_c + G_s)^2 \cdot R_N}{G_s}$$

$$\frac{\partial F}{\partial G_s} = 0$$

$$\Rightarrow \frac{2(G_c + G_s) R_N}{G_s} - \left[\frac{G_u + (G_c + G_s)^2 \cdot R_N}{G_s^2} \right] = 0$$

$$\cdot G_s^2 = \frac{G_u}{R_N} + G_c^2$$

Condition for power match:

$$Y_s = Y_{in}^*$$

$$F = f(G_s - G_{\text{opt}}, B_s - B_{\text{opt}})$$

$$F = F_{\min} + \left[(G_s - G_{\text{opt}})^2 + (B_s - B_{\text{opt}})^2 \right] \cdot \frac{R_N}{G_s}$$

