

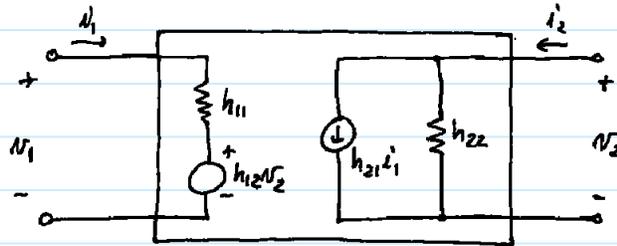
Loading from the FB Network

Ex: Series-Shunt FB (now including loading from the FB network)

Series Connection: resistors & voltage sources add when in series \rightarrow so represent amplifiers & FB networks by R 's & V 's to make the math simpler

Shunt Connection: conductances & current sources add when in parallel \rightarrow so represent amplifiers & FB networks by G 's & I 's to make the math simpler

For these representations, use h-parameter networks for a & f.



Port Equations:

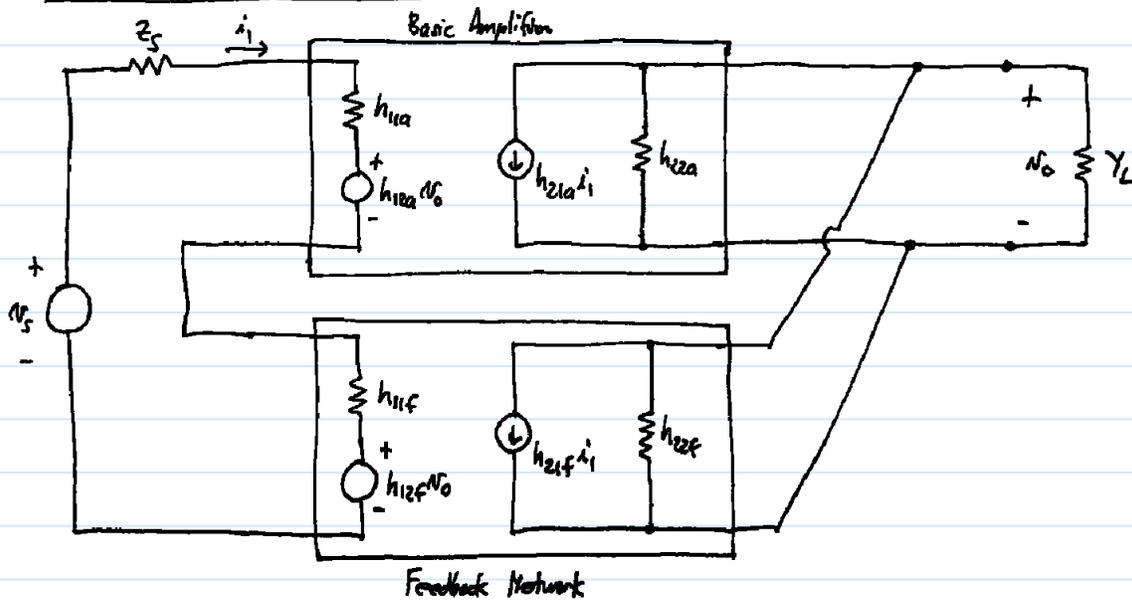
$$V_1 = h_{11}i_1 + h_{12}V_2$$

$$i_2 = h_{21}i_1 + h_{22}V_2$$

Elements: $h_{11} = \frac{V_1}{i_1} \Big|_{V_2=0}$ $h_{12} = \frac{V_1}{V_2} \Big|_{i_1=0}$

$h_{21} = \frac{i_2}{i_1} \Big|_{V_2=0}$ $h_{22} = \frac{i_2}{V_2} \Big|_{i_1=0}$

h-parameter representation of the series-shunt FB ckt:

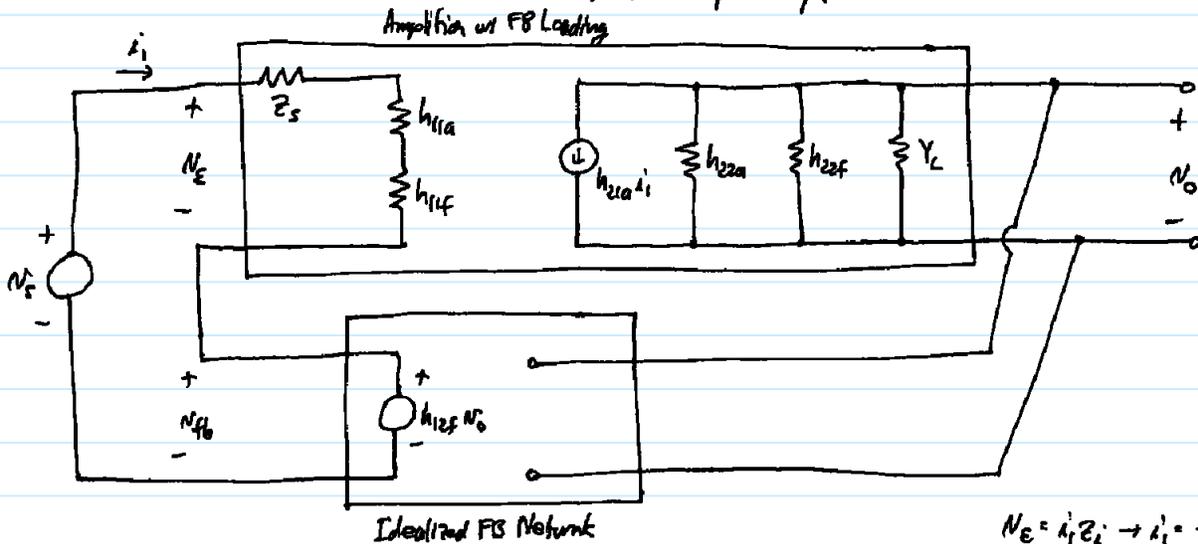


In general, transfer amplifiers & FB networks are uni-directional \rightarrow they have large gains in the forward direction, but very small gains in the reverse:

$$|h_{12a}| \ll |h_{12f}| \rightarrow \text{neglect } h_{12a} \text{ (set to 0)}$$

$$|h_{21a}| \gg |h_{21f}| \rightarrow \text{neglect } h_{21f} \text{ (set to 0)}$$

⇒ move impedances to idealize the FB network → once ideal, we can use the general equations we derived previously!



$$Z_i = Z_s + h_{11a} + h_{11f}$$

$$Y_o = Y_L + h_{22a} + h_{22f}$$

$$\frac{N_o}{N_s} = A = \frac{a}{1+af}, \text{ where}$$

$$\left\{ \begin{array}{l} a = -\frac{h_{21a}}{Z_i Y_o} \\ f = h_{12f} \left(= \frac{N_{fb}}{N_o} \right) \end{array} \right.$$

$$N_s = i_1 Z_i \rightarrow i_1 = \frac{N_s}{Z_i}$$

$$N_o = h_{21a} i_1 / Y_o$$

$$\therefore \frac{N_o}{N_s} = a = \frac{-h_{21a} i_1}{Y_o Z_i i_1}$$

Thus, the key to inspection analysis of FB ckt: X for FB impedances to load the basic amplification, then use our "inspection" formulas.