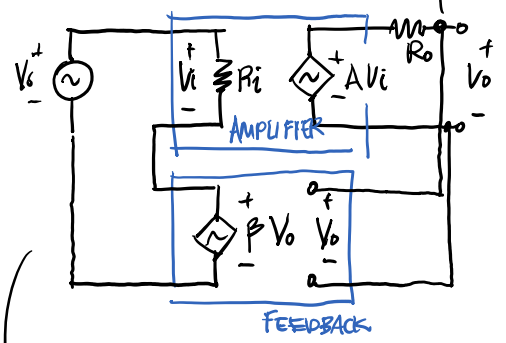
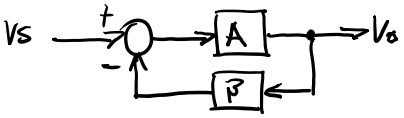
IO Impedance Control

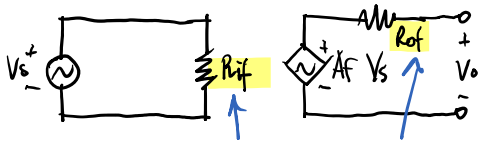
November 21, 2017 11:21

Consider Series-Shunt Feedback Amplifier. (Voltage Amplifier)



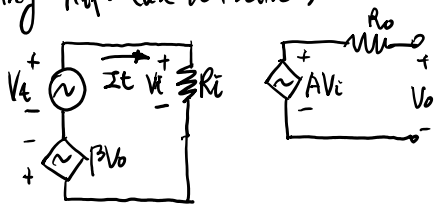


The equivalent model with feedback is:



I/O impedance with feedback

Finding Rif: (use test source)



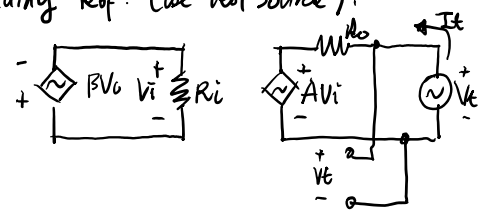
$R_{if} = \frac{V_t}{I_t}$, $I_t = \frac{V_i}{R_i}$, $V_t = V_i + \beta V_o$, $V_o = AV_i$

$V_t = V_i + A\beta V_i$

$R_{if} = \frac{R_i V_t}{V_i}$

$R_{if} = R_i(1+A\beta)$

Finding Rof: (use test source):



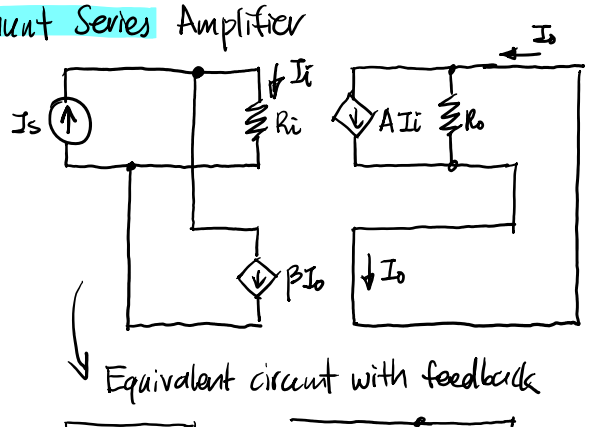
$R_{of} = \frac{V_t}{I_t}$, $I_t = \frac{V_t - AV_i}{R_o}$, $V_i = -\beta V_o$, $V_o = V_t$

$I_t = \frac{V_t + A\beta V_t}{R_o}$

$R_{of} = \frac{R_o V_t}{V_t + A\beta V_t}$

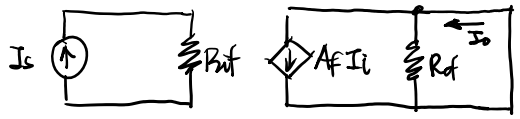
$R_{of} = \frac{R_o}{1 + A\beta}$

Shunt Series Amplifier (current amplifier)



Equivalent circuit with feedback

↓ Equivalent circuit with feedback



Using test sources to find I/O impedance: $R_{if} = \frac{R_i}{1+A\beta}$

$R_{of} = R_o(1+A\beta')$

Shunt - Shunt Feedback Amplifier: $R_{if} = \frac{R_i}{1+A\beta}$

(Transresistance) $R_{of} = \frac{R_f}{1+A\beta}$

$I_s \rightarrow V_o$

Series - Series Feedback Amplifier: $R_{if} = (1+A\beta)R_i$

(Transconductance) $R_{of} = (1+A\beta)R_o$

$V_s \rightarrow I_o$