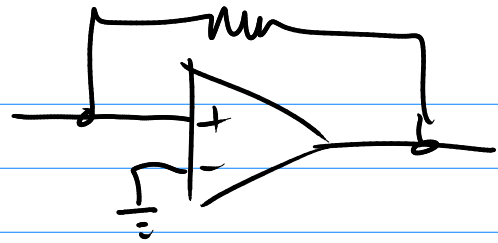
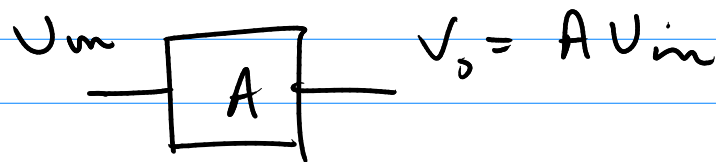


5. OP-AMP

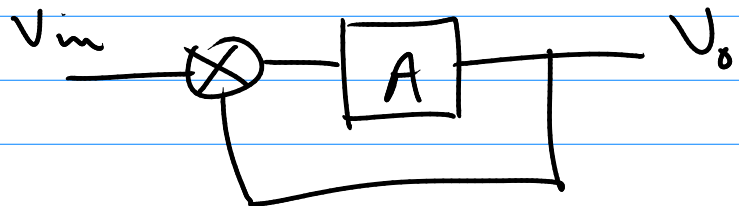


Gain = A
with A larger $\sim 10^5$

Block diagram



with feedback



$$V_o = AV_{in} \pm AV_o$$

↑ positive or negative feedback

Solve \Rightarrow

$$\frac{V_o}{V_{in}} = \frac{A}{1 \mp A}$$

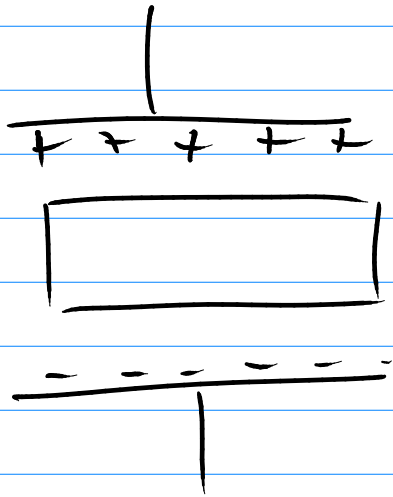
Positive feedback is OK for $A < 1$

$$\text{Then } \frac{V_o}{V_{in}} = \frac{A}{1-A} \approx A(1+A+A^2+\dots)$$

OR

$$V_o = \underbrace{V_{in} A}_{\text{no feedback}} + \underbrace{V_{in} A A}_{\text{go around loop once}} + \underbrace{V_{in} A A^2}_{\text{around loop twice}}$$

This looks like eqns for



$$E_{tot} = \frac{\sigma_f}{\epsilon_0} - \frac{\sigma_b}{\epsilon_0}$$

$\epsilon_0 \chi_e E_{tot}$
"

$$E_{tot} = \frac{\sigma_f}{\epsilon_0} - \chi_e E_{tot}$$

negative feedback

or

$$V = AV_{in} \pm AV_o$$