AEC 33.2 21/4/22

- Properties of Negative feedback:-

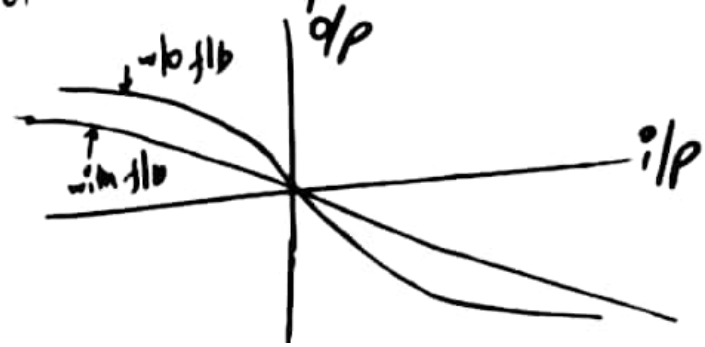
$$\frac{Y}{X} = \frac{A_1}{1+KA_1} \approx \frac{1}{K} \quad \text{if } KA_1 >> 1$$

(1) Gain Desensitization $\Rightarrow \frac{Y}{X_o}$ is less sensitive to temperature, supply, etc than A_1 is.

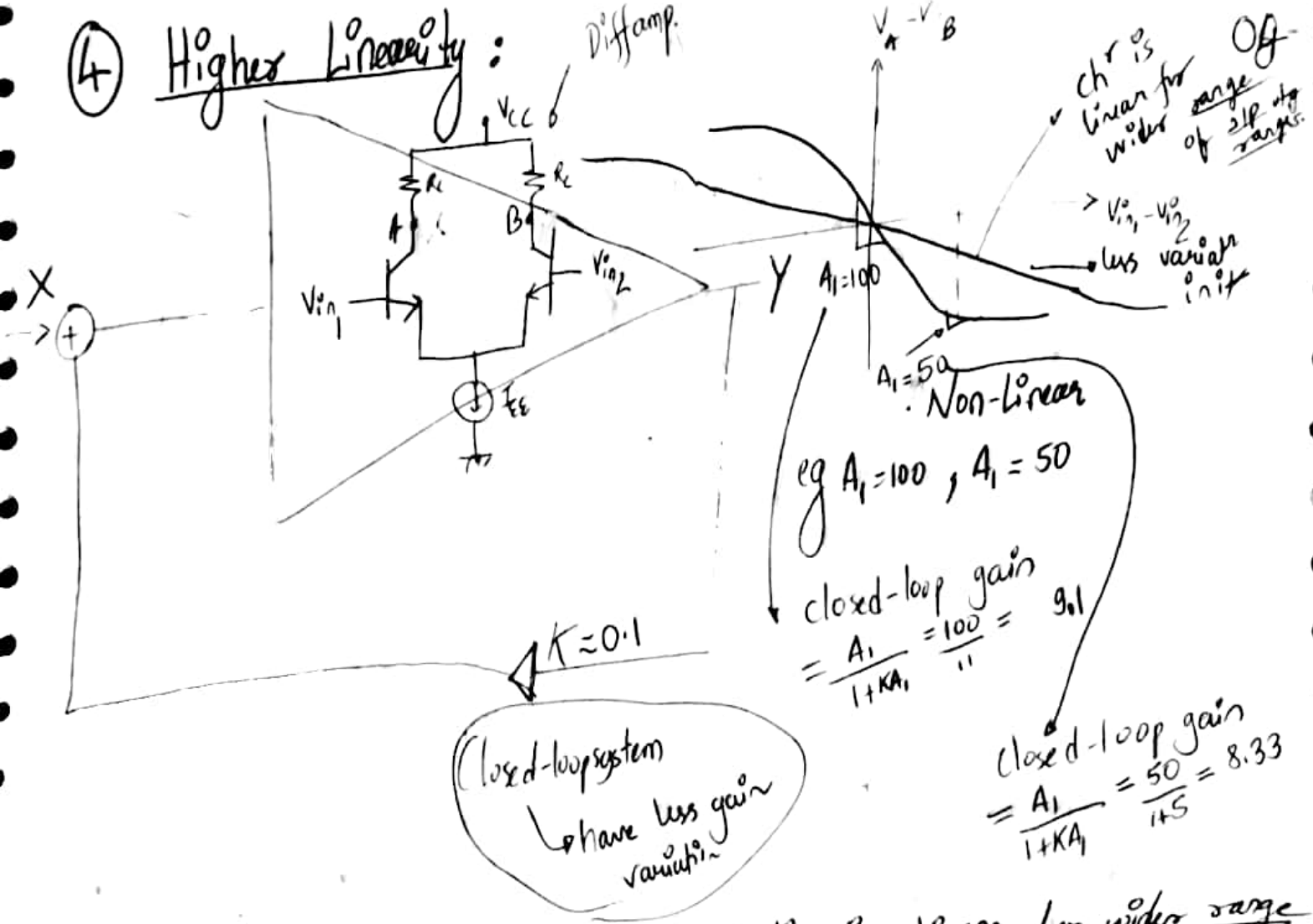
2) Bandwidth Extension: Greater BW for closed -loop system 05

3) Modification of Input and output impedances.

4) Higher Linearity { eg



④ Higher Linearity :



eg $A_1 = 100$, $A_1 = 50$

closed-loop gain $= \frac{A_1}{1+KA_1} = \frac{100}{11} = 9.1$

Closed-loop system
↳ have less gain variation

Closed-loop gain $= \frac{A_1}{1+KA_1} = \frac{50}{1+5} = 8.33$

→ Higher linearity means that characteristics is linear for wider range of i/p voltages.

A Few Quick Notes

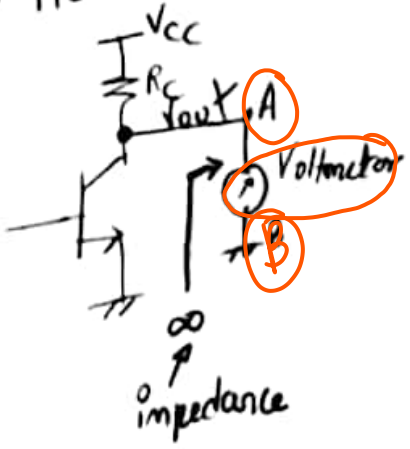
a) Ideal Vs Real sources

	Ideal	Real (with Internal resistance)
Voltage source (const, variable, dependent or indep)	V_s 5V	R_s, V_s 5V, ≠5V, 4.9V
Current source	I_s 1mA	I_s 1mA, R_s, ≠1mA

For a good voltage source, R_s is small

For a good current source, R_s is high

b) How do we measure a voltage or a current?

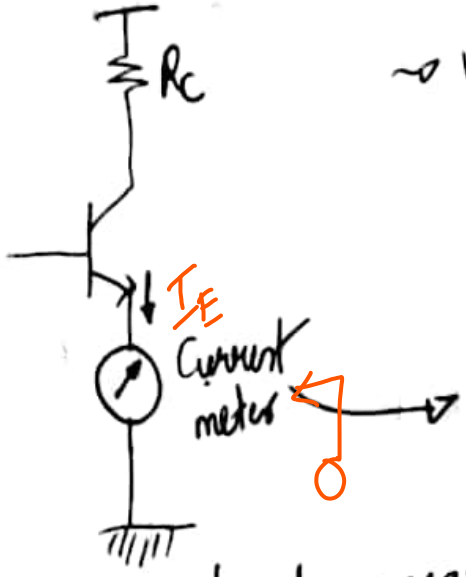


- Voltmeter should measure the voltage without disturbing or loading the circuit. (w/o changing the gain of the ckt)
- That is possible → only if the impedance of the voltmeter is infinite.
- So, this circuit doesn't feel that we connected something betn A & B

- So, an ideal voltmeter has an infinite impedance.

(So any device or ckt that is suppose to measure voltage must have an ∞ i/p impedance).

high in practise.



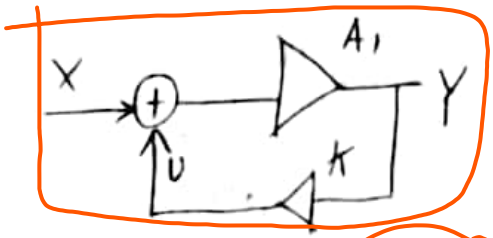
→ We don't want to insert a 02 disturb the ckt while inserting the current meter.

→ impedance should be Low

Any device or ckt wants to measure current or sense a current must have Low impedance.

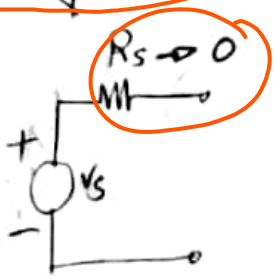
Review of topics:-

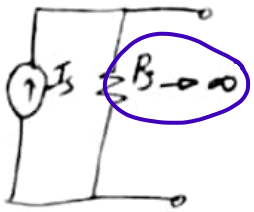
- Properties of Feedback:



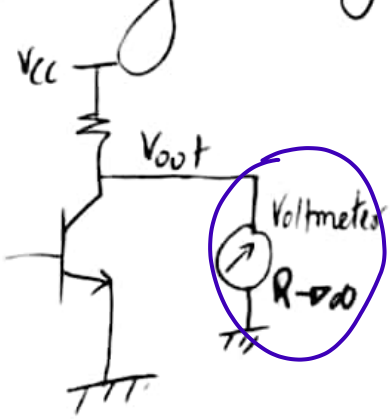
$$\frac{Y}{X} = A_f = \frac{A_1}{1+KA_1} \approx \frac{1}{K}$$

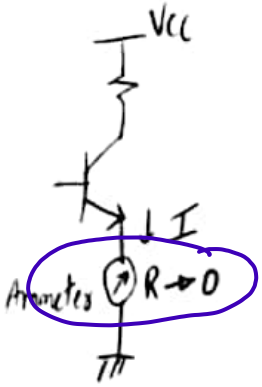
- "Good" Voltage and Current sources:-





- Sensing Voltages and currents:-

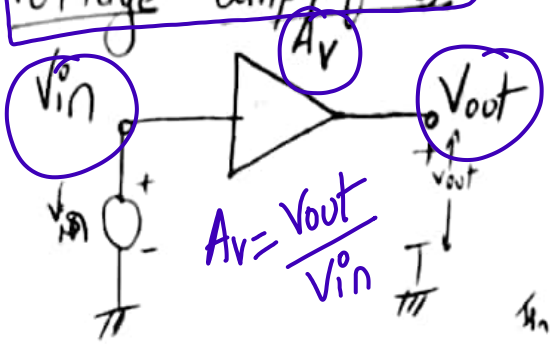




Types of Amplifiers:-

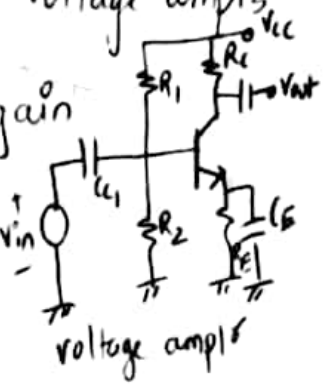
$V_{in} \longrightarrow V_{out} \Rightarrow A_V$

1. Voltage amplifiers:-



$A_V = \frac{V_{out}}{V_{in}}$

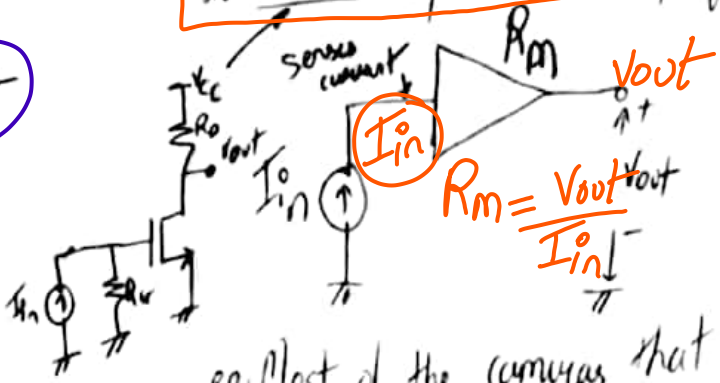
eg CE stage, cascode ampl^r, CB ampl^r are voltage ampl^{r}s



→ A_V : voltage gain

$A_V = \frac{V_{out}}{V_{in}}$

2. Transimpedance amplifiers:-

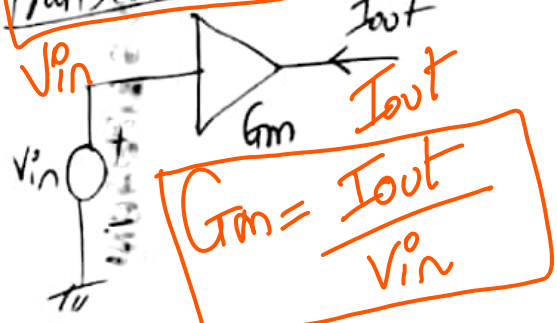


eg Most of the cameras that captures images, in it a sensor has a current for every pixel & that current has to flow through a ampl^r like above

2. Optical communication:-

→ $Gain = \frac{V_{out}}{I_{in}} = R_m$ Unit: Ω

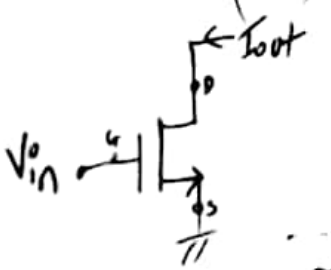
3. Transconductance Amplifiers:-



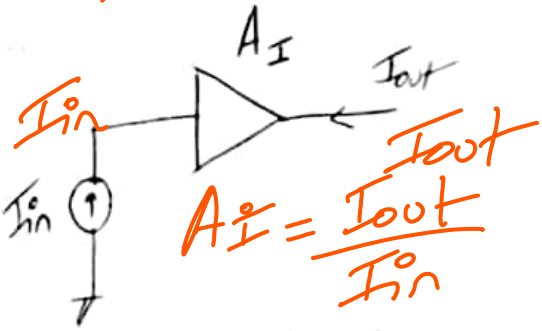
$G_m = \frac{I_{out}}{V_{in}}$

$Gain = \frac{I_{out}}{V_{in}} = G_m$

Unit:- $\left(\frac{1}{\Omega}\right)$



4. Current Amplifier

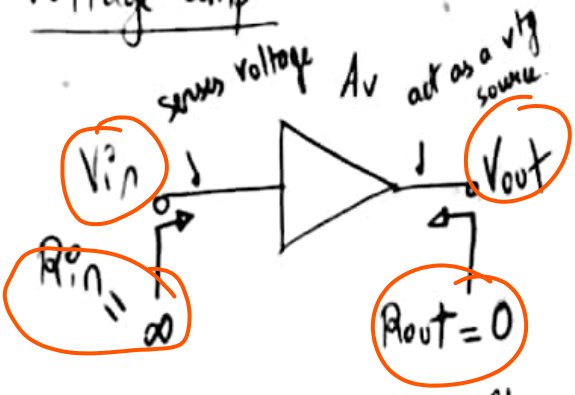


→ A_I : current gain

→ $A_I = \frac{I_{out}}{I_{in}}$

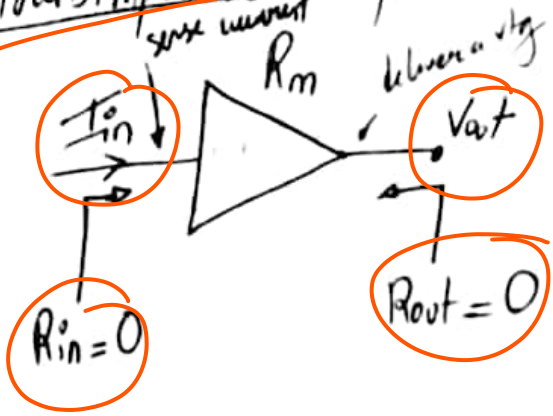
Input and Output Impedances of Four Amp. Topologies:-

1. Voltage ampl^r:-

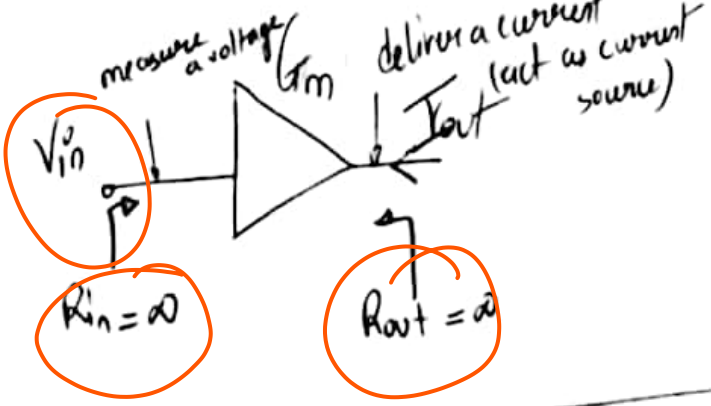


→ V. Ampl^r interfaces easily with outside world if $R_{in} = \infty$ (ie it doesn't load the preceding ckt) and $R_{out} = 0$ (ie it drive any load)

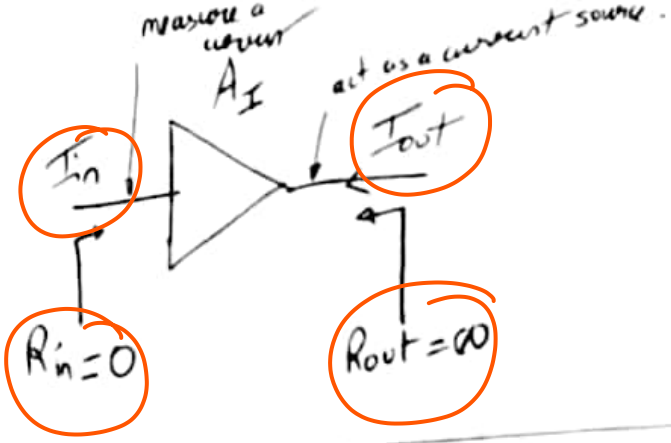
2. Transimpedance ampl^r:-



3. Transconductance ampl^r:-



4. Current ampl^r:



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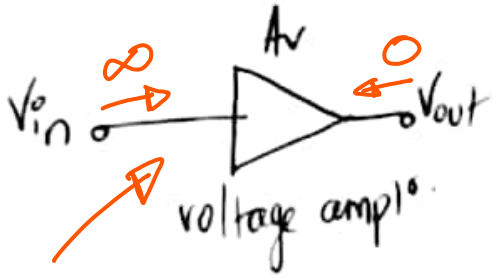
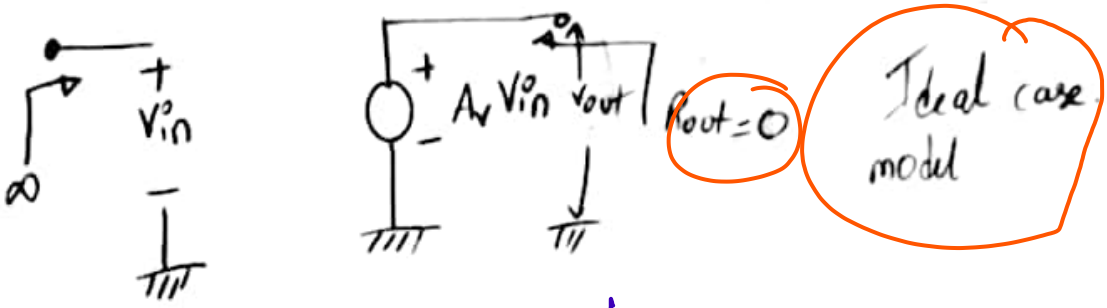
Models of four Amplifier Topdogies :-

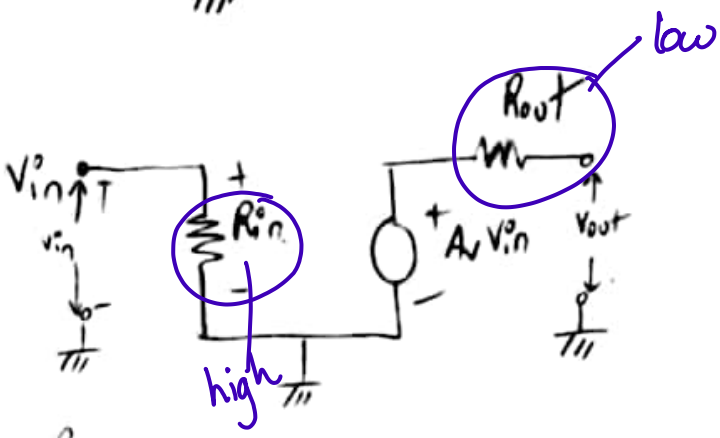
(1)



→ This ckt generates a vtg Vout at the o/p equal to $A_v \times V_{in}$. That's a dependent vtg source

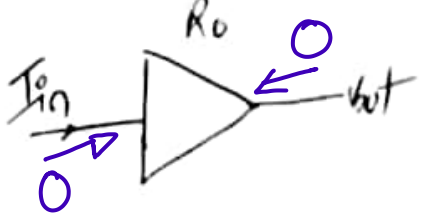
$V_{out} = A_v V_{in}$



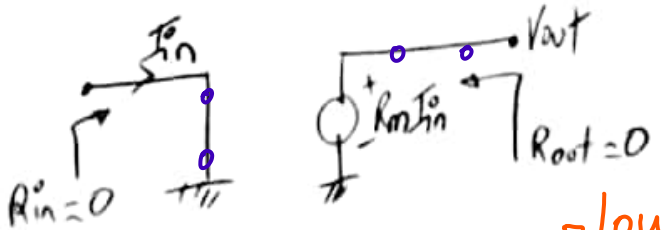


model of Actual voltage ampl'r

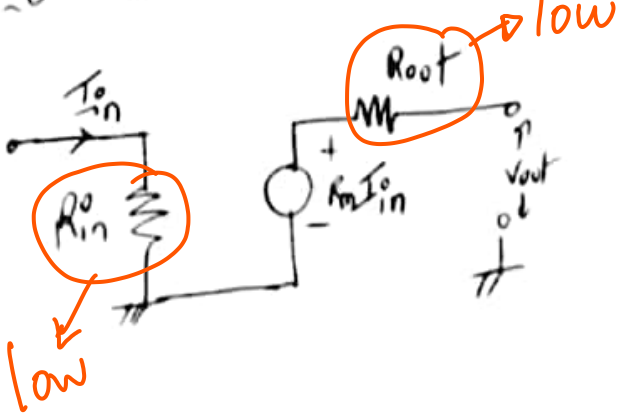
(2)



Transimpedance ampl'r



Ideal model



Actual model

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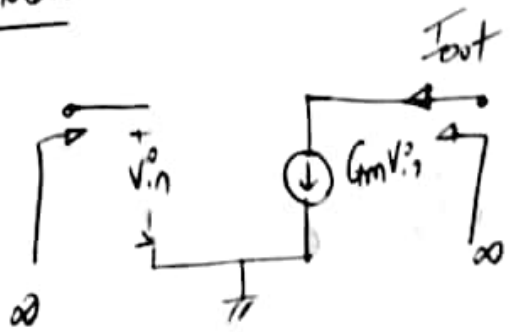
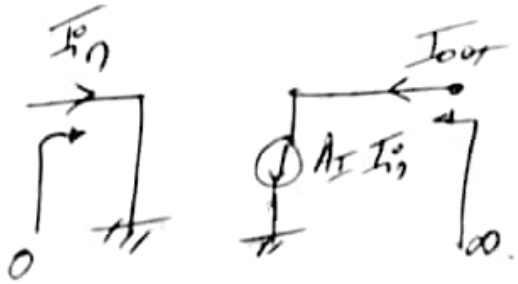
3. V_{in} I_{out}

Transconductance amplr.

4. I_{in} I_{out}

Ideal model





Actual model