تقدم لجنة ElCoM الاكاديمية

دفتر لمادة:

الكترونيات 2

جزيل الشكر للطالب:

قتيبة الكعابنة

1) R_E in C.E

- is used to stabilize Q.pt against [advantages]
  ↳ β-Variation
- Reduce AV and AI [disadvantages]
- Increase Ri [advantages]
- Stabilize AV and AI against β-variation [advantages]

2) when C_E is connected

1) Dc-values unchanged
2) AV, AI, increase
3) Ri decrease

3) Characteristics of C.E

1) AV > 1,
2) AI > 1
3) Φ :- phaseshift 180
4) Ri :- Moderate

Ro :- moderate to high

4) Characteristics of C.C [Emitter follower]

1) AV ≤ 1
2) high Current gain AI > 1
3) Ri :- high
4) Ro :- Low
5) Φ :- zero

* it used 1) power Amp
  2) Buffer [minimize Loading effect]
  or :- to provide No Loading effect

5) Characteristics of C.B [Current-Follower]

1) high Voltage gain $A_V > 1$

2) Low Current gain $A_i < 1$

3) R_i :- Low , 4) R_o :- high

ϕ :- Zero

6) Darlington

1) A_i very high $\approx \beta^2$

2) R_i high

7) Cascode :- used as wide band Amp

1) Common Source

i) Basic

- Rin

~~Av~~ $R_{ing} = \infty$

$R_{in} = R_1 // R_2 = R_g$

R_i seen by the Voltage Source = $R_{in} + R_{is}$

- Rout

$R_o = r_o // R_D$

ii) with R_s

R_s is used to stabliz Qpt aganst K_n Variation

$R_{ing} = \infty$

$R_{in} = R_1 // R_2$

R_i seen--- = $R_{is} + R_{in}$

$R_o = R_D$

iii) with bypass Cap (C_s)

$R_{in} = R_1 // R_2$

$R_{ing} = \infty$

R_{in} seen... = $R_{is} + R_{in}$

$R_o = R_D$

* إضافة Cap
يقوم بزيادة Av من
الحالة (ii)

* مواصفات Common Source

1) Av أكبر من (1)

2) زاوية الطور 180°

3) Ro <= متوسط إلى عالي

4) $R_{in} = R_{in}$

* 2) Common Drain [Source - Follower]

1) $A_V < 1$ — لا نستخدمه ك ~~Am~~ Voltage Amp

2) R_o Low $\Rightarrow R_o = \frac{1}{g_m} \parallel r_o \parallel R_S$

3) $R_{in} = R_G$

4) $\phi = 0$

* 3) Common Gate

1) $A_V > 1$

2) $\phi = 0$

3) $R_{in} = R_S \parallel R_{ins} = R_S \parallel \frac{1}{g_m}$ Low

4) $R_o = R_D$ ~~Low to~~ Moderate to high ~~to~~

*

Cascode: used high freq
[wide band Amp]

A_V Cascode $= A_V$ C.S

*

$I_D = K_n [V_{GS} - V_{TN}]^2$

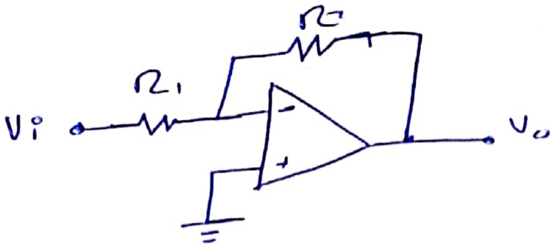
$V_{GS} = V_{TN} \pm \sqrt{\frac{I_D}{K_n}}$

$g_m = 2\sqrt{K_n I_D}$

$r_o = \frac{1}{\lambda I_D}$

* Linear

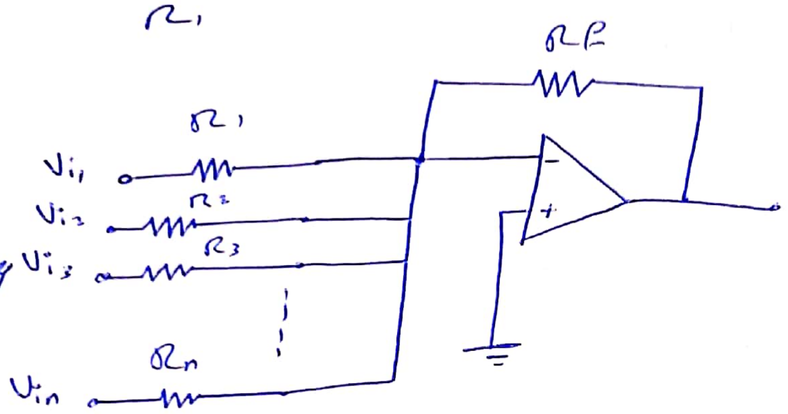
1) Inverting



$R_{in} = R_1$

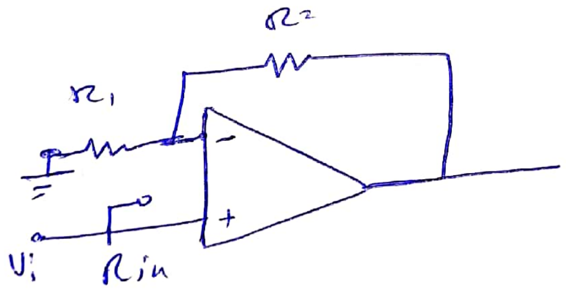
$$A_V = -\frac{R_2}{R_1}$$

2) Summing



$$V_o = \left[-\frac{R_f}{R_1} V_{i1} + \frac{R_f}{R_2} V_{i2} \text{------} - \frac{R_f}{R_3} V_{in} \right]$$

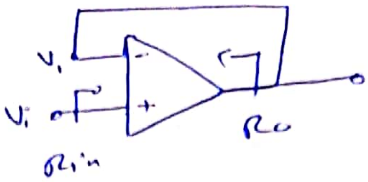
3) Non Inverting



$$A_V = \left[1 + \frac{R_2}{R_1} \right] = \frac{V_o}{V_i}$$

$R_{in} = \infty$

4) Voltage-Follower "Buffer"

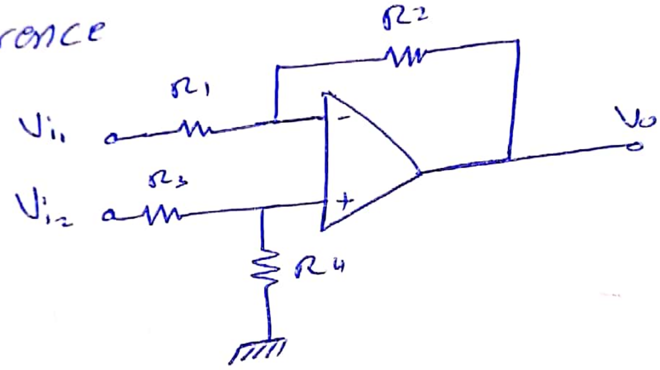


$[A_v = 1,\ R_{in} = \infty,\ R_o = 0,\ \phi = 0]$

Characteristics of Ideal Voltage-Follower

* used to minimize Loading effect

5) Difference



$$V_o = \left[\left(1 + \frac{R_2}{R_1}\right)\left(\frac{R_4}{R_3 + R_4}\right) V_{in2} - \frac{R_2}{R_1} V_{i1}\right]$$

if $\frac{R_4}{R_3} = \frac{R_2}{R_1}$

$$A_d = \frac{R_4}{R_3} = \frac{R_2}{R_1} \qquad R_{id} = R_1 + R_3$$

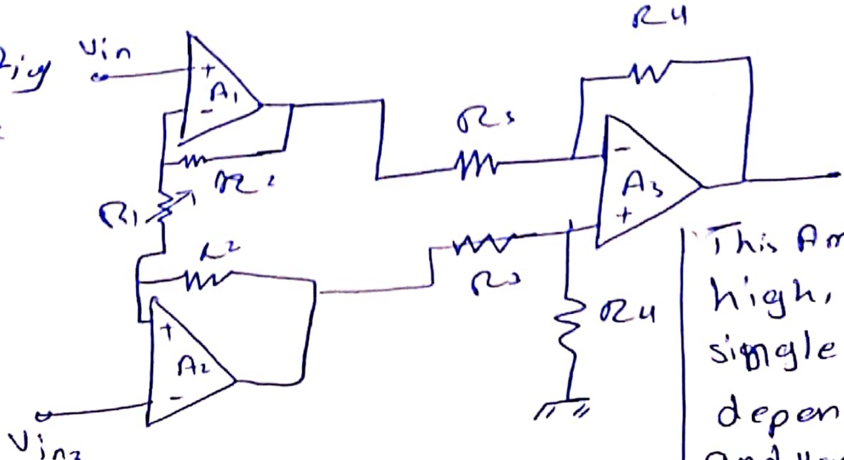
6) Instrumention

1) A_1, A_2 => noninverting
   A_3 => Difference

2) $R_{in1} = \infty$, $R_{in2} = \infty$
   $R_{id} = \infty$

3) $A_d = \frac{R_4}{R_3}\left[1 + \frac{2R_2}{R_1}\right]$

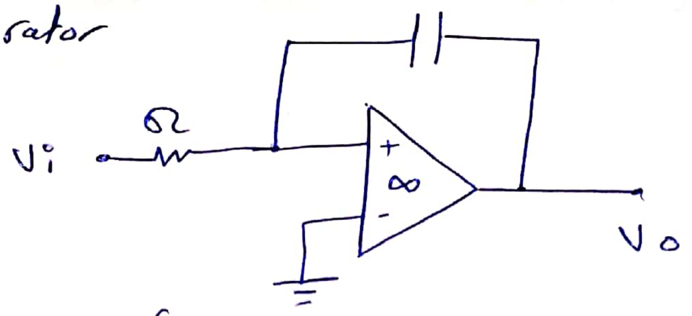
$\frac{A_{min}}{R_4/R_3} > 1$ for design



to change Ad we change R_1 only

This Amp achieves high, adjustable, single-element dependent gain and very high input R for R using proper values

7) Integrator

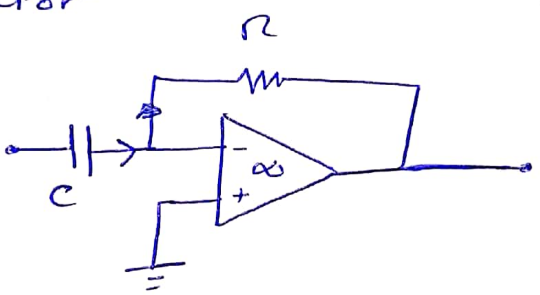


$$V_o = \frac{-1}{RC} \int v_i \, dt$$

$V_i \Rightarrow$ Square

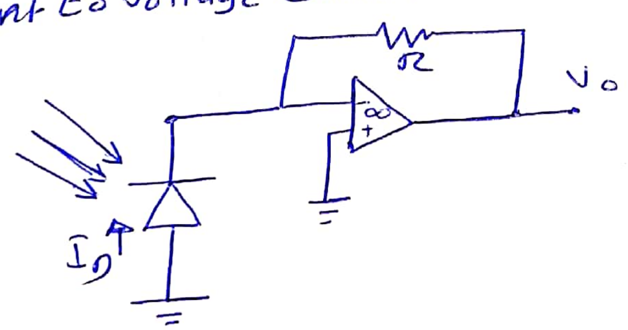
$V_o \Rightarrow$ Triangular

8) Differentiator



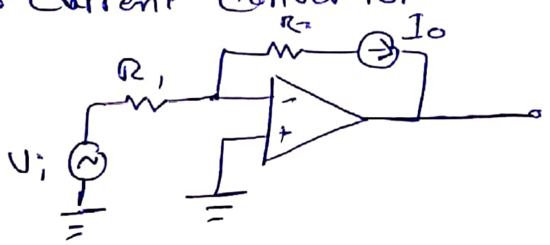
$$V_o = -RC \frac{dv_i}{dt}$$

9) Current to Voltage converter



$$V_o = -i_D R$$

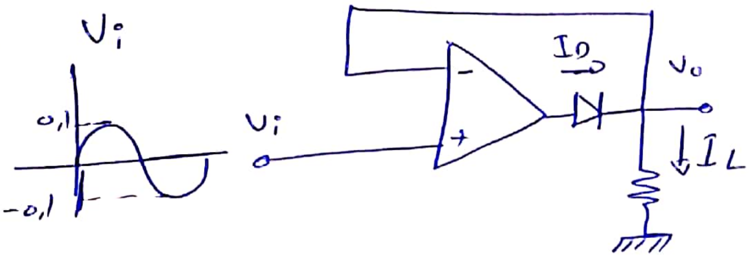
10) Voltage to current convertor

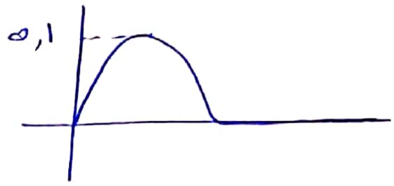


$$I_o = -\frac{V_i}{R_1}$$

* Non Linear

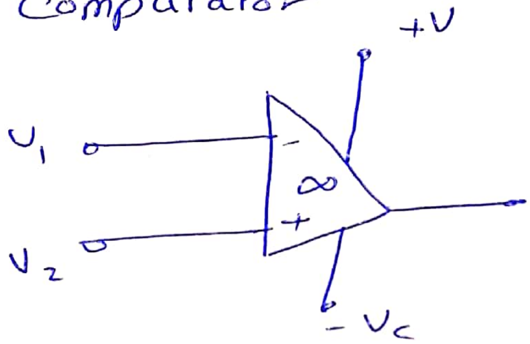
1) precision Half-wave Rectifier





$$V_{o\,avg} = \frac{V_{ip}}{\pi}$$

2) Voltage - Comparator

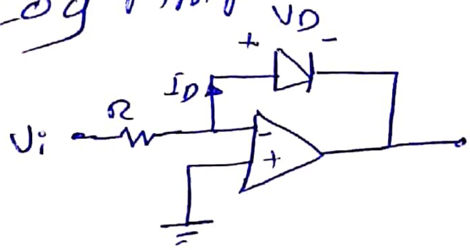


used in open loop mode [No connection between Vo and (-) terminal]

1) $V_2 > V_1$
   $V_o = +V_c$
2) $V_2 < V_1$
   $V_o = -V_c$

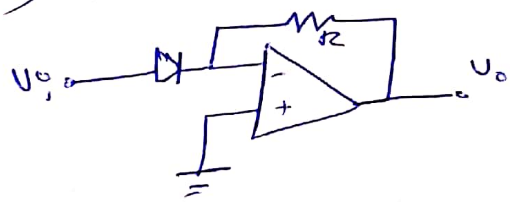
* If Vref = 0 then O/P is symmetrical square-wave and the circuit is called [zero-crossing detector

3) Log Amp



$$V_o = -nV_T \ln \frac{V_i}{I_s R_s}$$

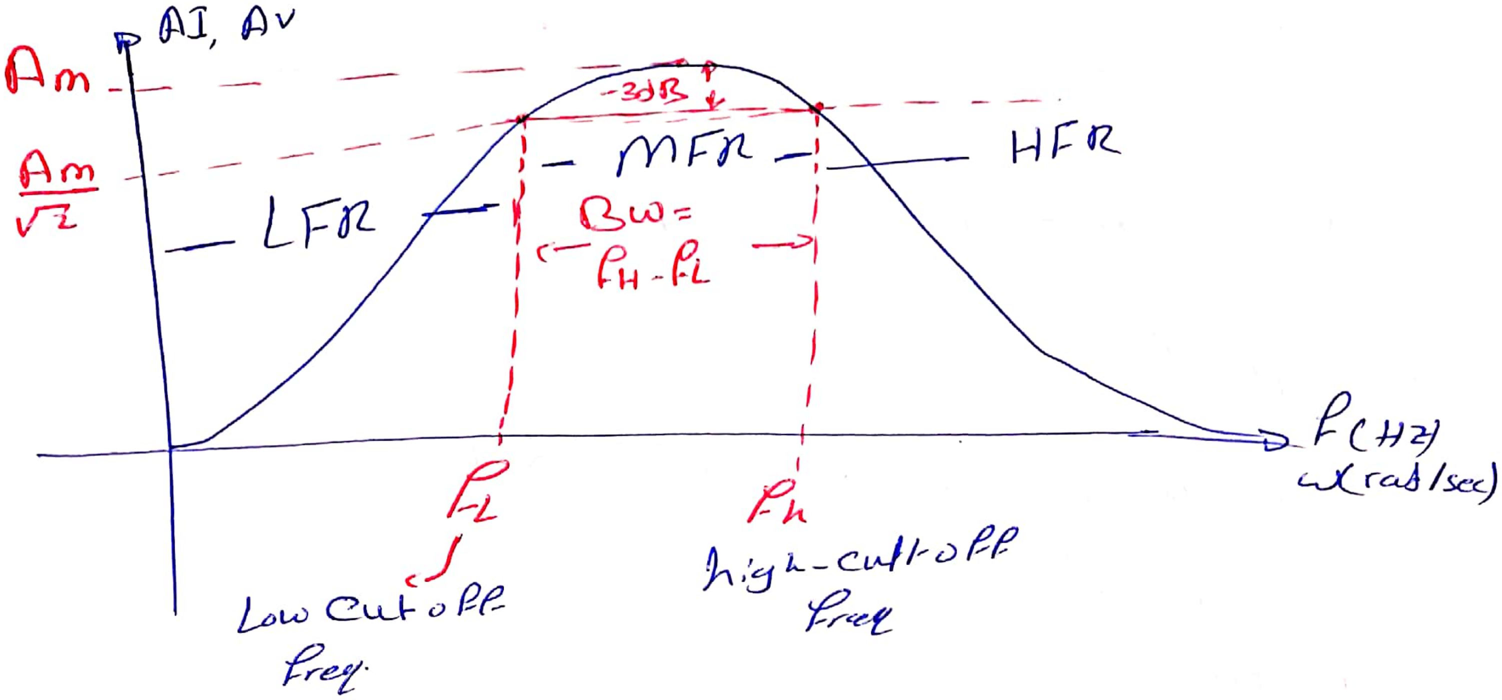
4) Antilog or Exponential



$$V_o = -I_s R\, e^{\frac{V_i}{nV_T}}$$

* Frequency Response

$A_V(dB) = 20\log A_V = 20\log \frac{V_o}{I_s}$



1) Low freq - Regn

- This Regn extends from $[0 - f_L]$
- $f\uparrow$, $AV\uparrow$ علاقة طردية
- سبب وجود العلاقة الطردية بين f, Av هو وجود C_1, C_2, C_E

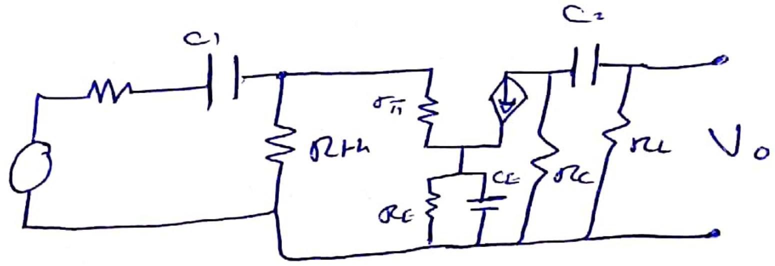
- سبب أن Av يعتمد على f لأن Cap متصلة توالي مع مسار input signal

$f\uparrow,\ X_C\downarrow,\ V_b\uparrow,\ V_C\uparrow,\ V_o\uparrow,\ A_V\uparrow$

$X_C = \frac{1}{2\pi f_C}$

* C_π and C_μ => O.C

$X_{C\pi} = \infty = X_{C\mu}$



2) Medium freq Regn

- This Regn extend from [f_L – f_H]
- This is a usful Regn of Amp operation
- In this Regn all coupling [C_1, C_2] and bypass (C_E) => short cct
- C_π, C_H => open cct , $X_{CH} = X_{C\pi} = \infty$

3) high freq Regn

- This Regn extend from [f_H – ∞]
- زيادة f يؤدي إلى تقليل Av
- C_1, C_2 and C_E => Shortcct
- C_π and C_H => راح تظهر تأثيرهن في هذه المنطقة
  * ما الهن وجود فيزيائي ولكن ظهرن بسبب التركيب الفيزيائي لـ BJT
- C_π :- B – E Jn [F.w biased Jn]
- C_H :- Reversed biased Jn

* Miller therm :- نظرية تقوم بتوزيع C_H

* $f\uparrow$, $X_C\downarrow$, $(R_L // X_{cm2})\downarrow$, $A_V\downarrow$

* C_L :- is connected in parallel with R_L to control f_H and make it not depend on C_H, C_π