28/06/2011.

① feedback Amplifiers

The portion of o/p is fed back to the ~~the~~ input

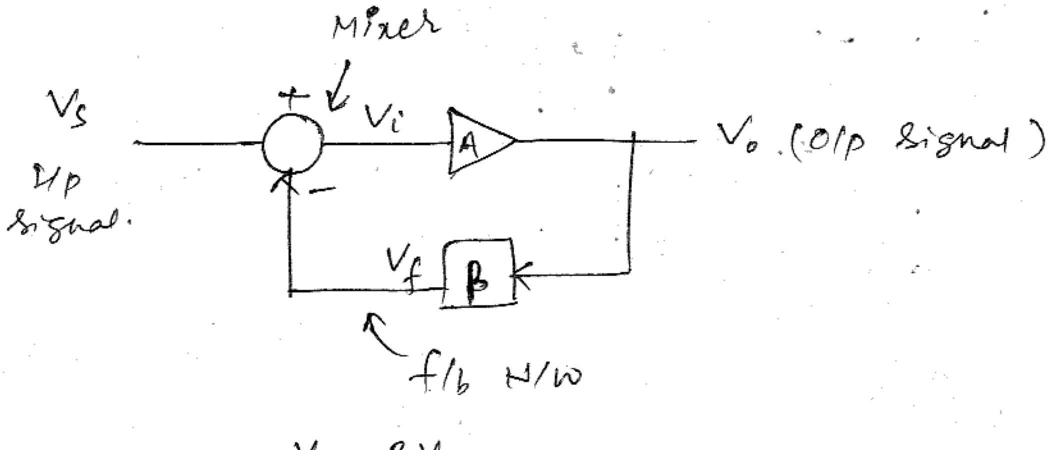
i) +ve f/b
ii) -ve f/b

+ve f/b : In +ve f/b, the output signal sample is going to ~~feed the~~ be in phase with the i/p signal.

-ve f/b : The f/b signal sample is going to 180° out of phase.

-ve f/b results in decrease voltage gain for which the no. of ~~co~~ circuits ~~of~~ features are improved.

+ve f/b ~~drain~~ rise the ckt. to the oscillator.



$$V_f = \beta V_0$$

↑ f/b factor

Fig. Block diagram of f/b Amplifier

while, it results in overall voltage gain, the no. of improvements are obtained.

i) Higher i/p impedance of the circuit.

ii) Better stabalized voltage gain.

iii) Improved fequency Response

iv) Lower o/p impedance.

v) Reduced noise.

vi) More linear operation.

F/b Connection types

i) voltage series f/b.

ii) current " ".

iii) voltage shunt f/b.

iv) current " ".

- series f/b connections tend to increase the i/p resistance,
- shunt f/b connections tend to decrease the i/p resistance.
- voltage f/b decreases the o/p impedance
- current f/b tends to increase the o/p impedance.

i)

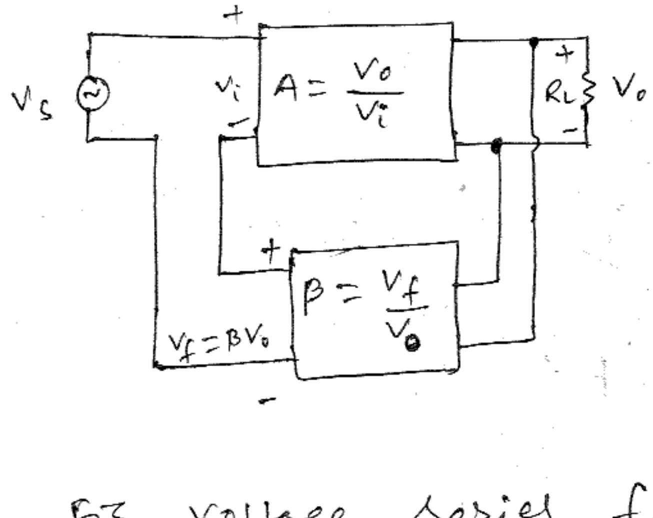
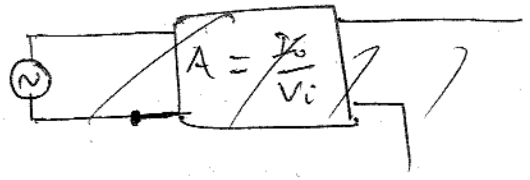


Fig. Voltage series f/b



ii)

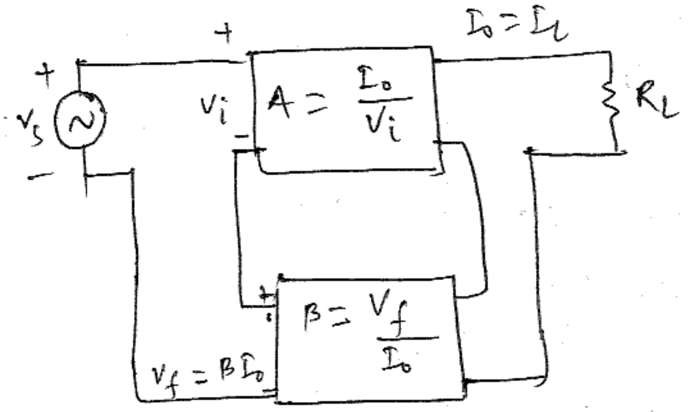


Fig. current series f/b

iii)

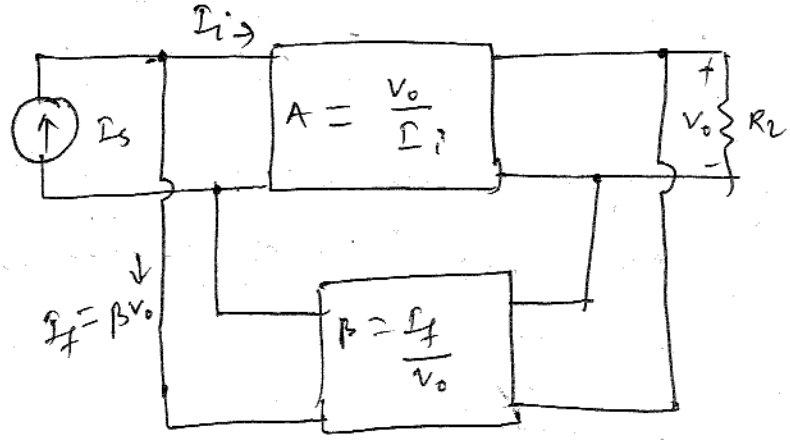


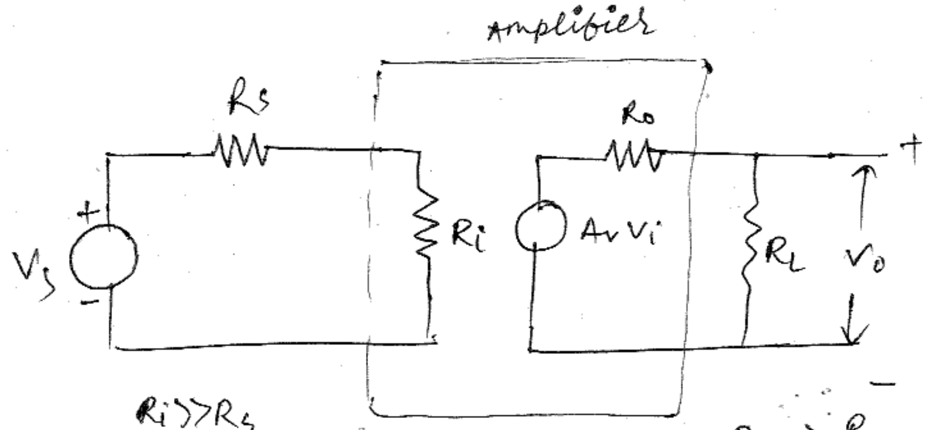
Fig. voltage shunt f/b.

21/08/17

Amplifiers based on magnitude of I/p and O/p Resistance relating to source and load Impedance.

i) voltage amplifier.
ii) current "
iii) Trans Conductance amplifier
iv) Trans resistance "

i) voltage amplifier



$R_i >> R_s$ $R_L >> R_o$

- If amplifier ~~i/p~~ R_i is large compare with source ~~R~~ Resistance (R_s)

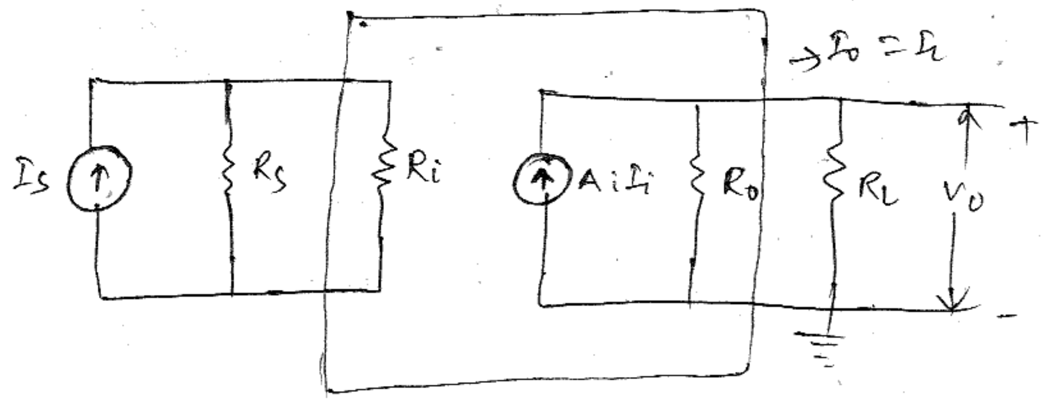
then, $V_i = V_s$

- If external load (R_L) is large compared with O/p resistance (R_o) of the amplifier then $V_o = A_v V_i \cong A_v V_s$.

Such amplifier provides a voltage O/p ~~prop~~ $V_o \propto V_i$ and the proportionality factor does not depend on source and load resistance.

- An ideal amp. must have infinite i/p resistance and zero o/p resistance.

ii) Current Amplifier



$R_i \to 0$

$R_i << R_s$

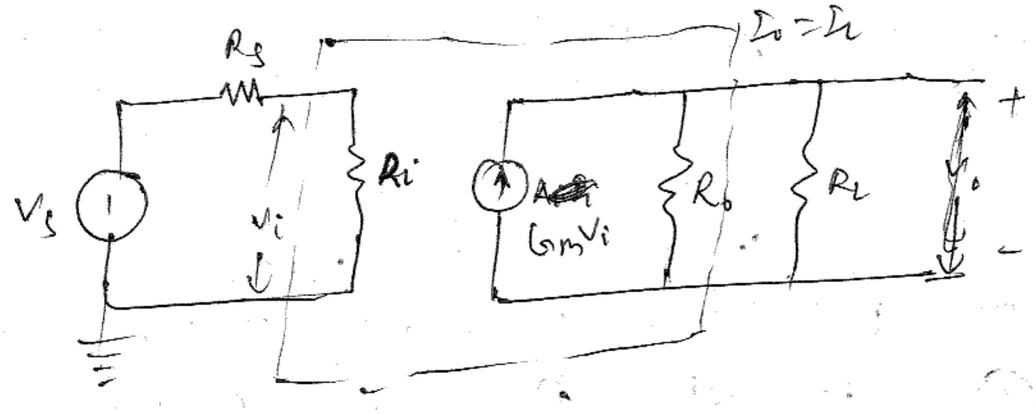
$R_o \to \infty$

$R_L << R_o$

er

iii) Trans Conductance amplifier

$G_m = I/V$



$R_i >> R_s$

$R_o >> R_L$.

iv) Trans Resistance

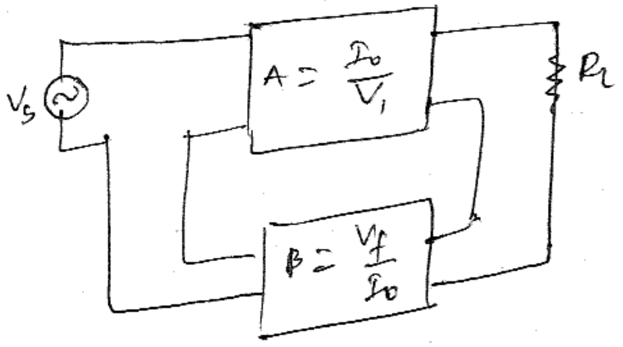
$R_i << R_s$

$R_o << R_L$

22-06/11.

current series f/b.

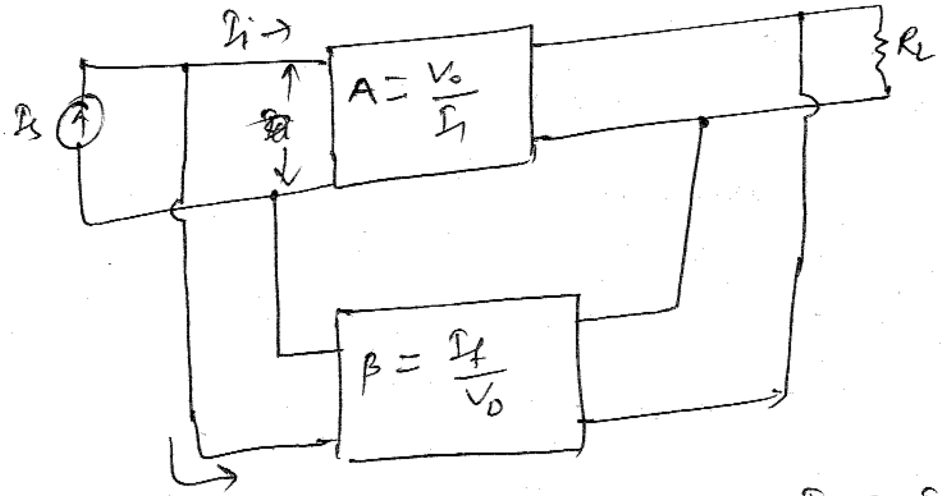
Transconductance



$V_f = \beta I_o$

Transresistance.

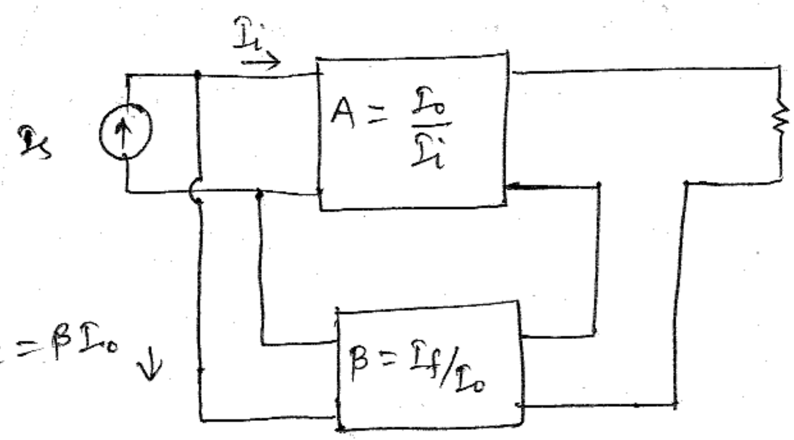
voltage shunt f/b



$I_i = I_s - I_f$

$I_f = \beta V_o$

current shunt f/b.



$I_f = \beta I_o$ ↓

Gain for voltage series f/b amp.

* If there is no f/b signal then

$$A = \frac{V_o}{V_s} \quad [\because \text{Refer to diagram}]$$

$$= \frac{V_o}{V_i}$$

* If V_f (f/b) is connected in series with the i/p then ($\because$ -ve f/b)

$$V_i = V_s - V_f$$

$$V_o = A V_i$$

$$= A(V_s - V_f)$$

$$= AV_s - AV_f$$

$$\therefore V_o = AV_s - A\beta V_o$$

$$V_o + A\beta V_o = AV_s$$

$$V_o(1 + A\beta) = AV_s$$

$$V_o = \frac{AV_s}{1 + A\beta} \qquad \therefore \boxed{\frac{V_o}{V_s} = \frac{A}{1 + A\beta}}$$

//.

$$\therefore A = \frac{AV_s / 1 + A\beta}{V_i} = \frac{AV_s}{V_i(1 + A\beta)}$$

$$A = \frac{AV_s}{V_i(1 + A\beta)}$$

$$V_i + A\beta V_i = V_s$$

$$A\beta V_i = V_s - V_i$$

$$A = \frac{V_s - V_i}{}$$

voltage shunt f/b

$$A_f = \frac{V_o}{I_s} = \frac{A I_i}{I_i + I_f} \quad [\because I_i = I_s - I_f]$$

$$= \frac{A I_i}{I_i + \beta V_o} = \frac{A I_i}{I_i + \beta A I_i}$$

$$A_f = \frac{A I_i}{I_i(1+A\beta)}$$

$$\therefore \boxed{A_f = \frac{A}{1+A\beta}}$$

Loop Gain $= -A\beta$ ($\because$ -ve f/b)

Distortion f/b

If β is made up of reactive components, the reactance of this component will change with the frequency changing the β.

As a result, gain will also change with frequency.

In tuned amplifiers, f/b network is desined such that at tuned frequency $\beta = 0$ and at other frequency, $\beta = \infty$. As a result, amplifier provides high gain for signal at tuned frequency and relatively reject all other frequencies

Noise and Non-linear distortion

signal feedback reduces the amount of noise signal and non-linear distortion. The factor '$1+\beta A$' reduces both input noise and resulting non-linear distortion for considerable improvement.

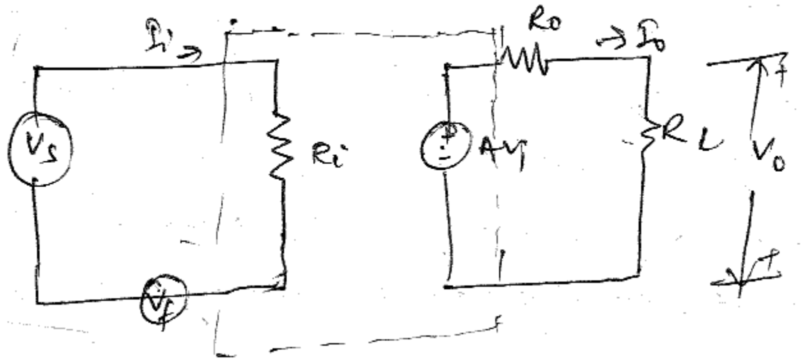
23/06/11.

Input resistance

- If f/b signal is added to the input in series due to the applied voltage, it increases the input resistance.

- f/b signal - in shunt - with applied voltage
  ⇒ I/p resistance decreases.

voltage series feedback amplifier



$V_f = \beta V_o$

$R_{if} = \frac{V_s}{I_i}$

Applying KVL to the i/p side,

$V_s - I_i R_i - V_f = 0$

$V_s = I_i R_i + V_f$

o/p voltage, $V_o = \frac{AV_i}{R_o+R_L} \cdot R_L$

$V_o = A_V V_i \rightarrow \left(\because A_V = \frac{AR_L}{R_o+R_L} \right)$

Sub. the value of V_o in (2)

$V_s = I_i R_i + \beta A_V V_i$

$V_s = I_i R_i + \beta A_V I_i R_i$

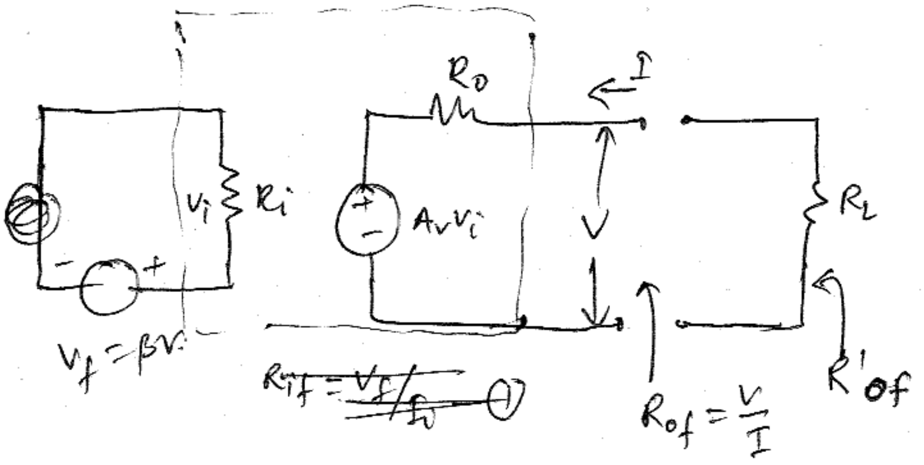
$\frac{V_s}{I_i} = R_i + \beta A_V R_i$

$$\boxed{\frac{V_s}{I_i} = R_i(1+\beta A_V)}$$

O/P Resistance

→ The -ve f/b which samples the O/P ~~current~~ voltage tends to decrease the O/P resistance, which samples the O/P current tends to increase O/P resistance.

→ ~~The -ve f/b which s~~



$A_V V_i + IR_o - V = 0$

$I = \frac{V - A_V V_i}{R_o}$ — (1)

I/p voltage,

$V_i = -V_f = -\beta V \cdot [\because V_s = 0]$ — (2)

Sub ② in ①

$$I = \frac{V + A_V \beta V}{R_o}$$

$$I = \frac{V(1 + \beta A_V)}{R_o}$$

So
$$\frac{V}{I} = \frac{R_o}{1 + \beta A_V}$$

So, $$R_{of} = \frac{R_o}{1 + \beta A_V}$$

$$R'_{of} = R_{of} \parallel R_L$$

$$= \frac{R_{of} R_L}{R_{of} + R_L} = \frac{\frac{R_o}{1+\beta A_V} \cdot R_L}{\frac{R_o}{1+\beta A_V} + R_L}$$

25/06/11.

Desensitivity

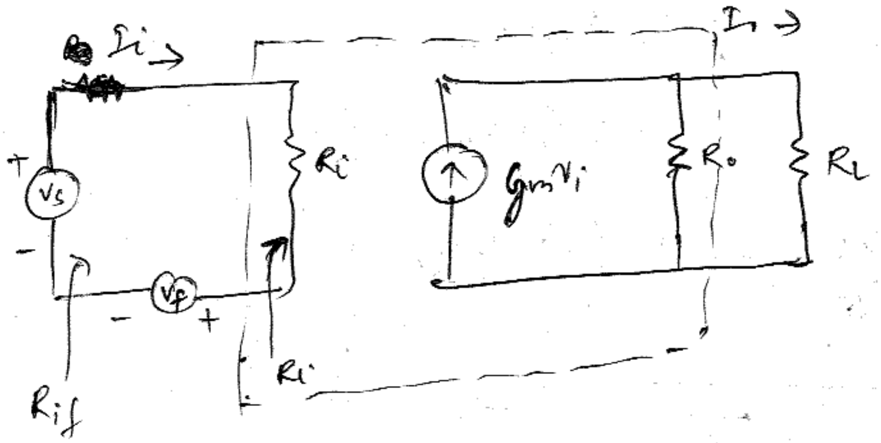
The fractional change in amplification with the feedback, divided by fractional change in amplification without feedback or transfer gain.

$$\text{Sensitivity} = \frac{1}{1 + \beta A}$$

Reciprocal of sensitivity is called desensitivity.

$$D = 1 + \beta A$$

current series feedback amplifier



~~$V_f = \beta V_o$~~ $V_f = \beta I_o$

$$R_{if} = \frac{V_s}{I_i}$$

Applying KVL in the i/p side.

$$V_s - I_i R_i - V_f = 0 \Rightarrow V_s - I_i R_i = \beta I_o \quad \text{—} \quad (1)$$

~~$\frac{V_s - V_f}{R_i} = I_i$~~ — (*)

$$I_o = \frac{g_m V_i \times R_o}{R_o + R_L} = G_M V_i \quad \text{—} \quad (2)$$

where the small ~~gm~~ Gm represents transconductance without feedback.

G_M represents transconductance with f/b taking R_L in account.

Now, sub.

from ① & ②

$$V_s - I_i R_i = \beta G_M V_i$$

$$V_s = \beta G_M I_i R_i + I_i R_i$$

$$V_s = I_i R_i (\beta G_M + 1)$$

$$R_{if} = \frac{V_s}{I_i} = R_i(1+\beta G_M)$$

∴ f/b Resistance (R_{if}) = $R_i(1+\beta G_M)$

Methods for analysing the f/b amplifier.

Step-1

I) Identify topology (type of f/b).

a) To find the ~~input circuit~~ type of sampling n/w.

i) By shorting the o/p i.e. V = 0, if f/b signal become zero. Then we can say, this is voltage sampling.

ii) By opening the output loop i.e. I = 0, the f/b signal become zero. Then it is said as current sampling.

b) To find the type of mixing network.

→ If the f/b signal is subtracted from the externally applied ~~voltage~~ signal as a voltage in the input loop, then it is said that it is series mixing.

→ If the f/b signal is subtracted from the externally applied signal as a current in the i/p loop, then it can be said as shunt mixing.

Thus, by ~~determing~~ determining the ~~and~~ type of sampling n/w & mixing n/w, the type of f/b can be determined.

Step-2 : Find the input circuit.

i) For voltage sampling ~~maye~~ make $V=0$ by shorting
ii) " current " make $I=0$ by opening the o/p loop.

Step-3 : Find the o/p circuit.

i) For series mixing, make $I=0$ by opening the i/p loop.

ii) For shunt mixing, make $V=0$ by shorting the i/p loop.

Step-4: Replace each device by its h-parameter model.

Step-5: Find the open loop gain.

Step-6: Indicate S_f and S_o in the ckt. and find out β.

Step-7: Find A_f, R_{if}, R_{of}, R'_{of} (R_L included).