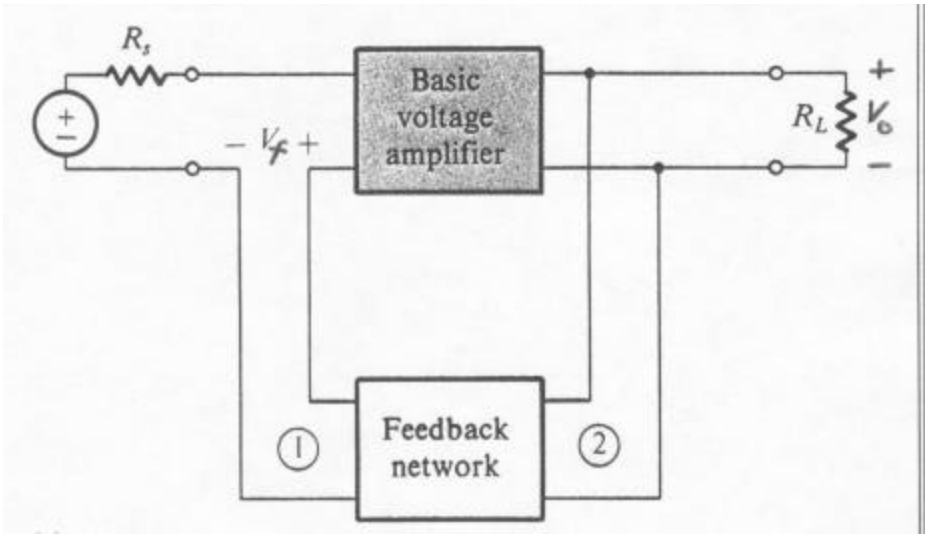
ANALOG (SAMPLE ASSIGNMENT)

1) A series-shunt feedback amplifier representable by figure 7.1 and using an ideal basic voltage amplifier operates with Vs=100mV, V_f=90mV and Vo=10V. What are the values of A and ß, which correspond? Include the correct units for each.
Solution:

V_f= ß*Vo
ß=Vo/V_f=90mV/10V=9mV/V

Vo=A(Vs-V_f)
A=Vo/(Vs-V_f)=10V/(100mV-90mV)=1V/mV



2) A series-Shunt feedback amplifier utilizes the feedback circuit shown in figure

a) Find the expressions for the *h*-parameters of the feedback circuit. (Figure 7.3 b)
Since: $V_1=h_{11}I_1+h_{12}V_2$
$I_2=h_{21}I_1+h_{22}V_2$

$$h_{11}=\left.\frac{V_1}{I_1}\right|_{V2=0}=R_1\|R_2$$

$$h_{12}=\left.\frac{V_1}{V_2}\right|_{I1=0}=\frac{R_2}{R_1+R_2}$$

$$h_{21} = \left.\frac{I_2}{I_1}\right|_{V2=0} = -\frac{R_2}{R_1 + R_2}$$

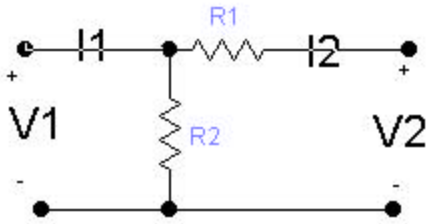
$$h_{22} = \left.\frac{I_2}{V_2}\right|_{I1=0} = \frac{1}{R_1 + R_2}$$

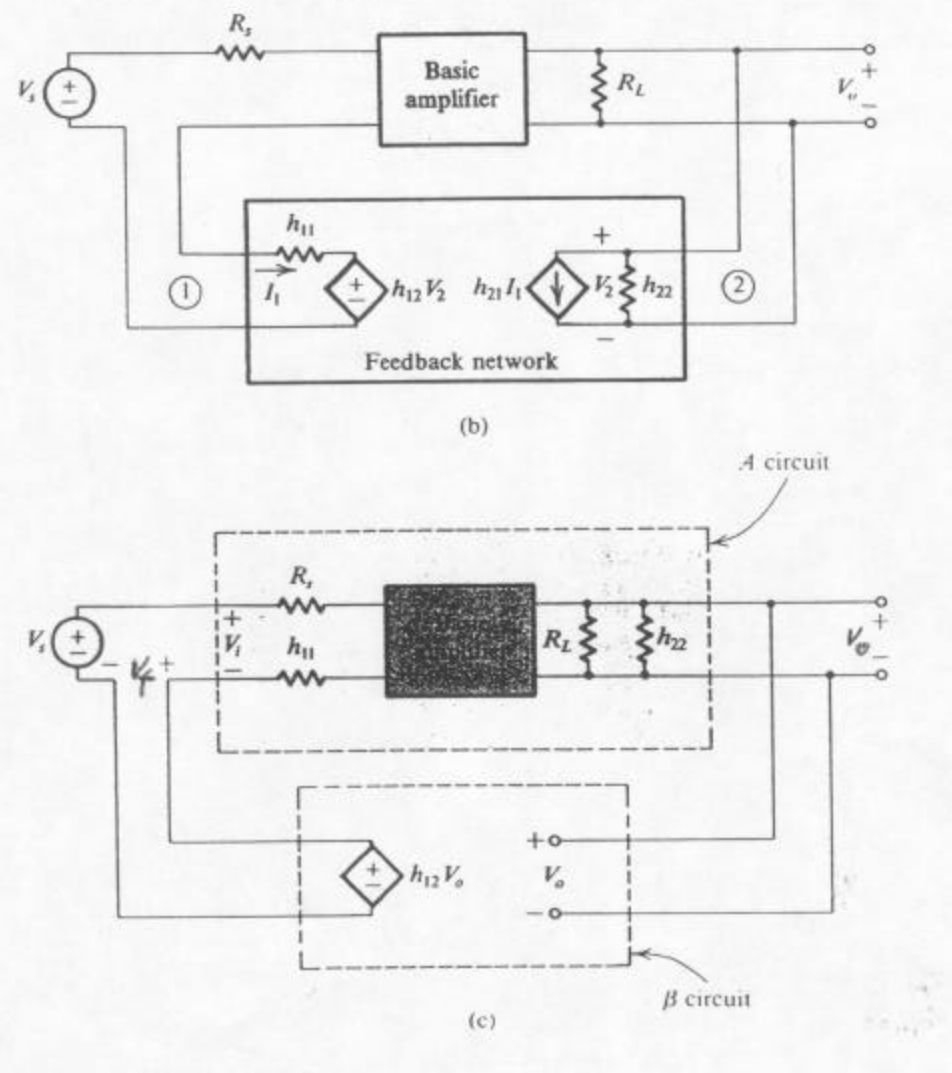
b) If R1=1 k ohm and ß=0.01, what are the values of all four *h*-parameters?

ß=h_{12}=0.01=R2/(R1+R2)
R1/R2=99
R2=R1/99=1000/99=10.1 ohm

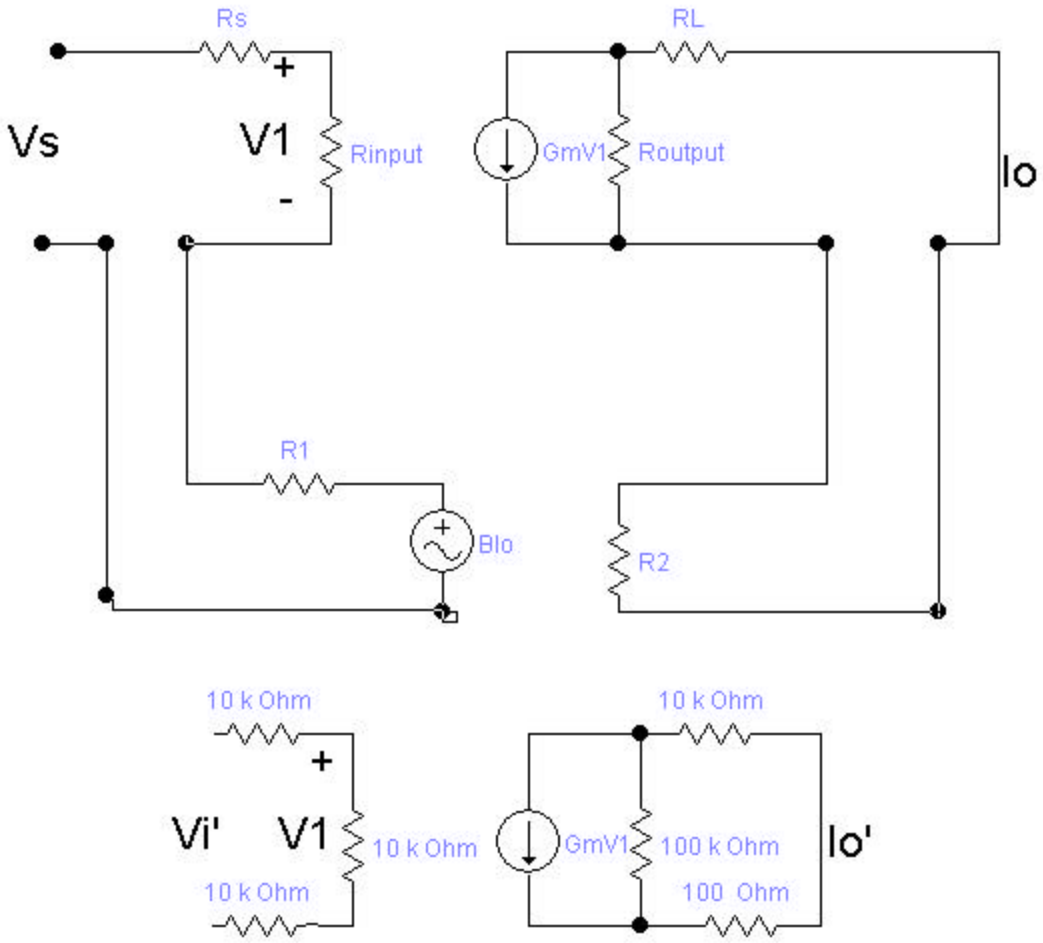
h_{11}=R1||R2=10 (ohm)
h_{12}=R2/(R1+R2)=0.01(V/V)
h_{21}=-h12=-0.01(A/A)
h_{22}=1/(R1+R2)=0.00099 (1/ohm)

c) For the case Rs=1 k ohm and R_L=1 k ohm, sketch and label an equivalent circuit following the model in figure 7.3 c.





3) A series-series feedback amplifier employs a transconductance amplifier having gm=100mA/V, input resistance of 10 Kohm, and output resistance of 100 k ohm. The feedback network has ß=0.01 V/mA, an input resistance (with port 1 open-circuited) of 100 ohm, and an input resistance (with port 2 open circuited) of 10 k ohm. The amplifier operates with a signal source having a resistance of 10 k ohm and with a load resistance of 10 k ohm. Find A_f, Rin, and Rout
Solution:



A circuit

Solution:

Use the A circuit, we can find out the A

V1=10/(10+10+10)*Vi'=Vi'/3

Io'=gmV1*100k/(100k+10k+100 ohm)

=gmVi'/3*100k/(100k+10k+100 ohm)

=100mA*1/3*100k/(100k+10k+100 ohm)Vi'

A=Io'/Vi'=30.28 mA/V

A_f=A/(1+A ß)=30.28/(1+30.28*0.1)=7.52 mA/V

Ri=Rs+Rinput+R1=30 k ohm

R_{if}=(1+A ß)*Ri=120.8 k ohm

Rin=R_{if}-Rs=120.8 k ohm-10 k ohm=110.8 k ohm

Ro=R_L+Routput+R2=110.1 k ohm

R_{of}=(1+A ß)*Ro=443.4 k ohm

Rout=R_{of}-R_L=443.4 k ohm-10 k ohm=433.4 k ohm