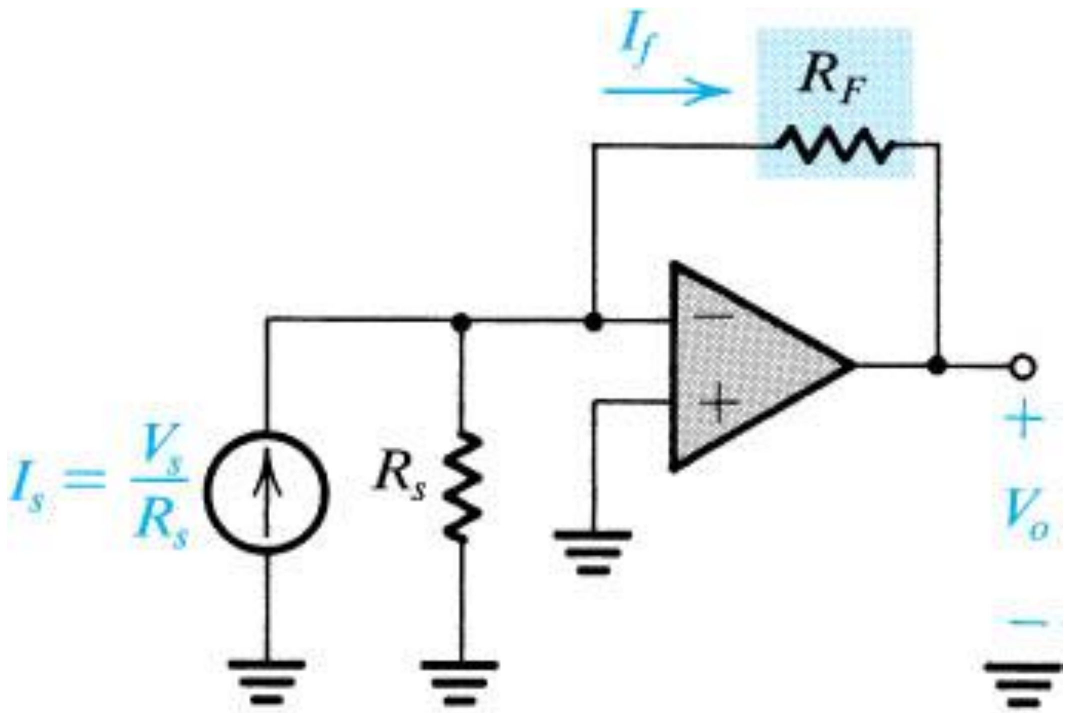
Lecture-4

Feedback Amplifier Configuration

The OP Amplifier withShunt-Shunt Feedback



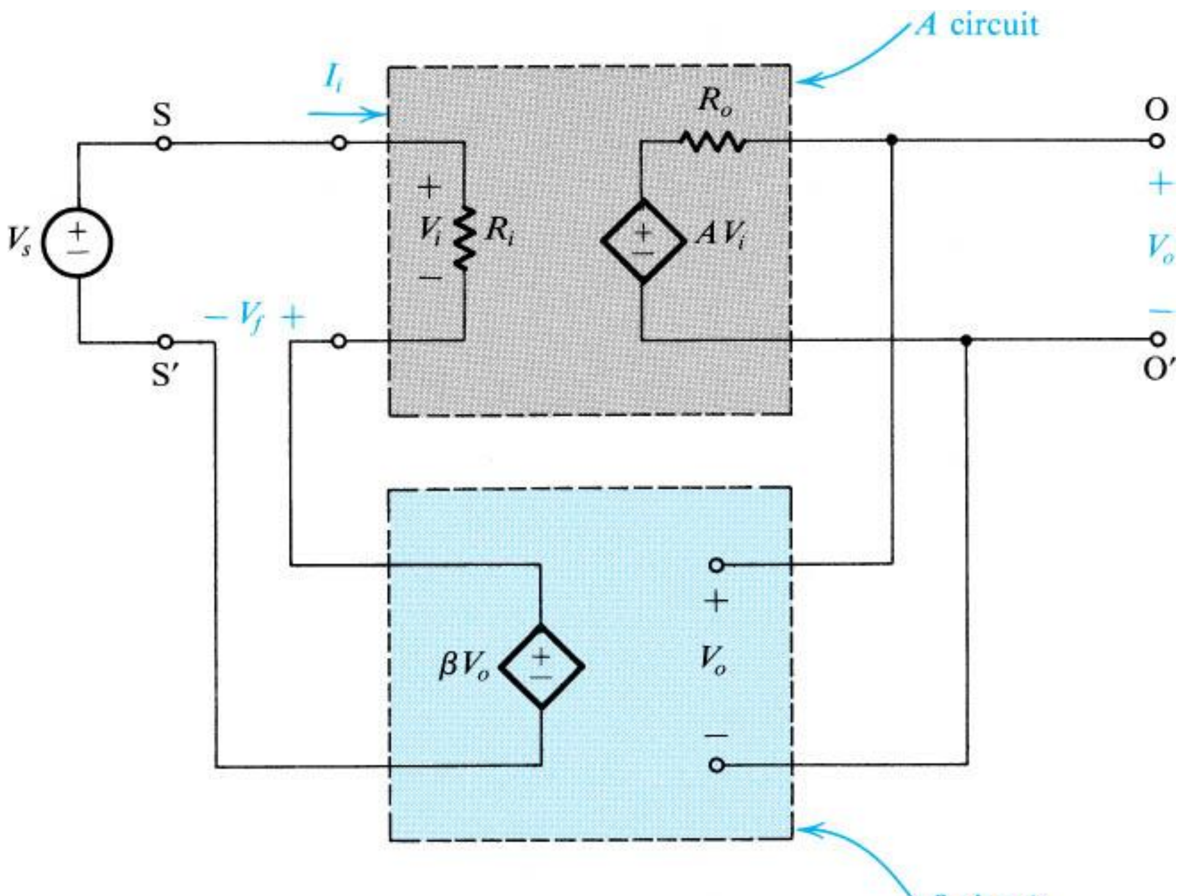
(b)

current-mixing voltage-sampling (shunt–shunt) topology

The Series-Shunt Feedback Amplifier

- The ideal situation
- The practical situation
- summary

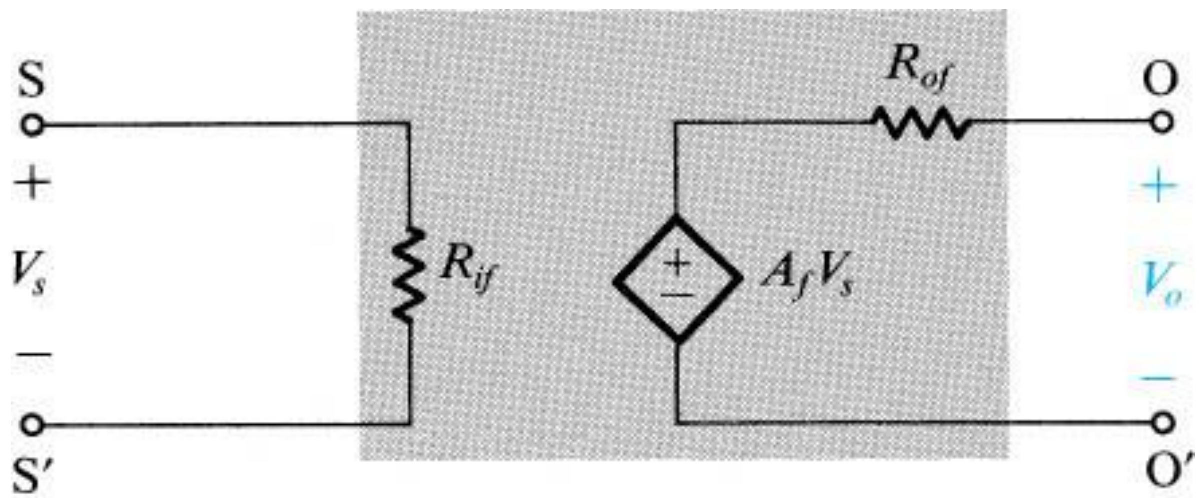
The Ideal Situation



(a)

- ➢A unilateral open-loop amplifier (A circuit).
- ➢An ideal voltage mixing voltage sampling feedback network (β circuit).
- ➢Assumption that the source and load resistance have been included inside the A circuit.

The Ideal Situation



(b)

Equivalent circuit.

R_{if} and R_{of} denote the input and output resistance with feedback.

Input and Output Resistance with Feedback

- Input resistance

$$R_{if} = R_i(1 + A\beta)$$

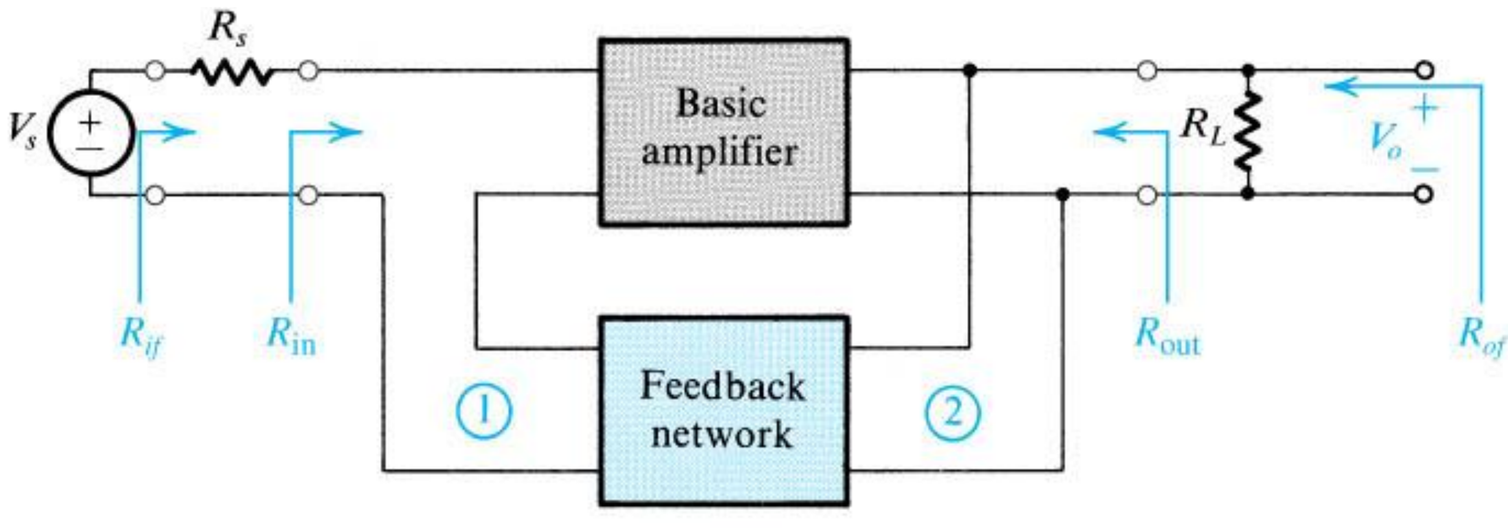
In this case, the negative feedback increases the input resistance by a factor equal to the amount of feedback.

- Output resistance

$$R_{of} = \frac{R_o}{1 + A\beta}$$

In this case, the negative feedback reduces the output resistance by a factor equal to the amount of feedback.

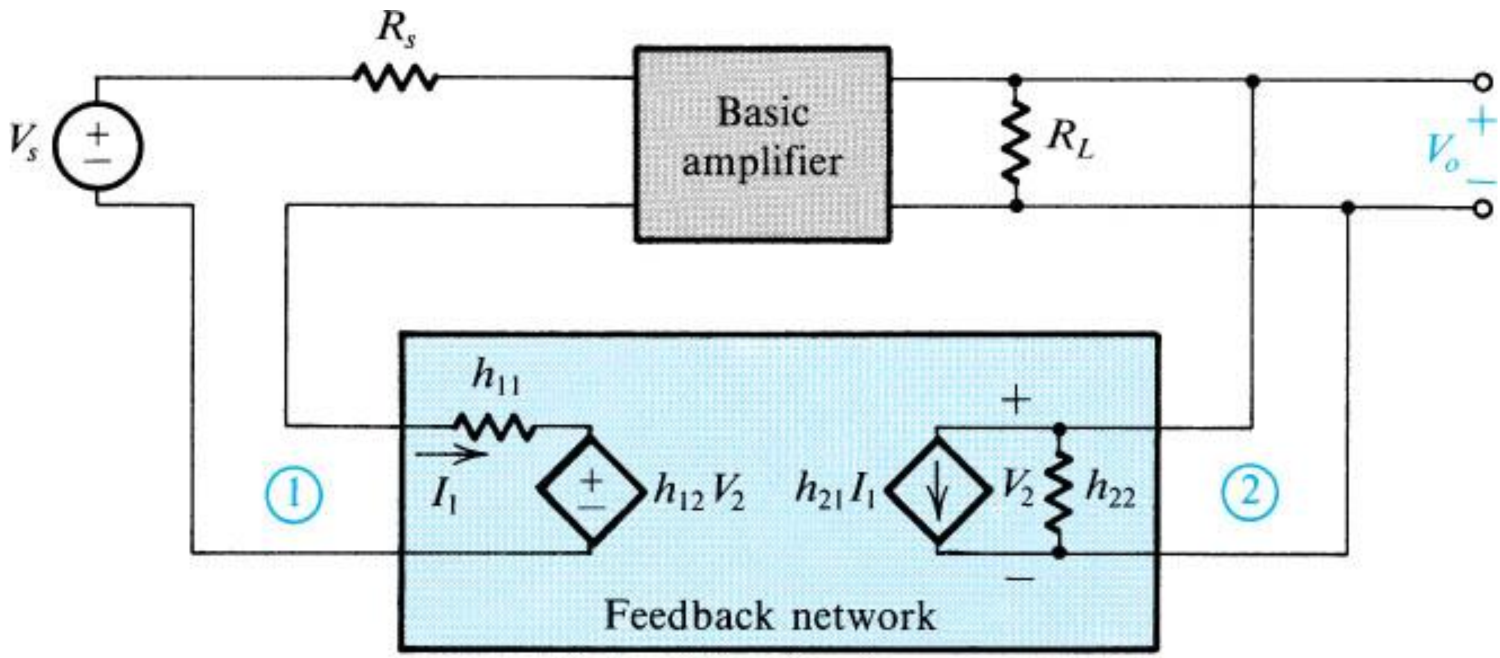
The Practical Situation



(a)

- ➢Block diagram of a practical series–shunt feedback amplifier.
- ➢Feedback network is not ideal and load the basic amplifier thus affect the values of gain, input resistance and output resistance.

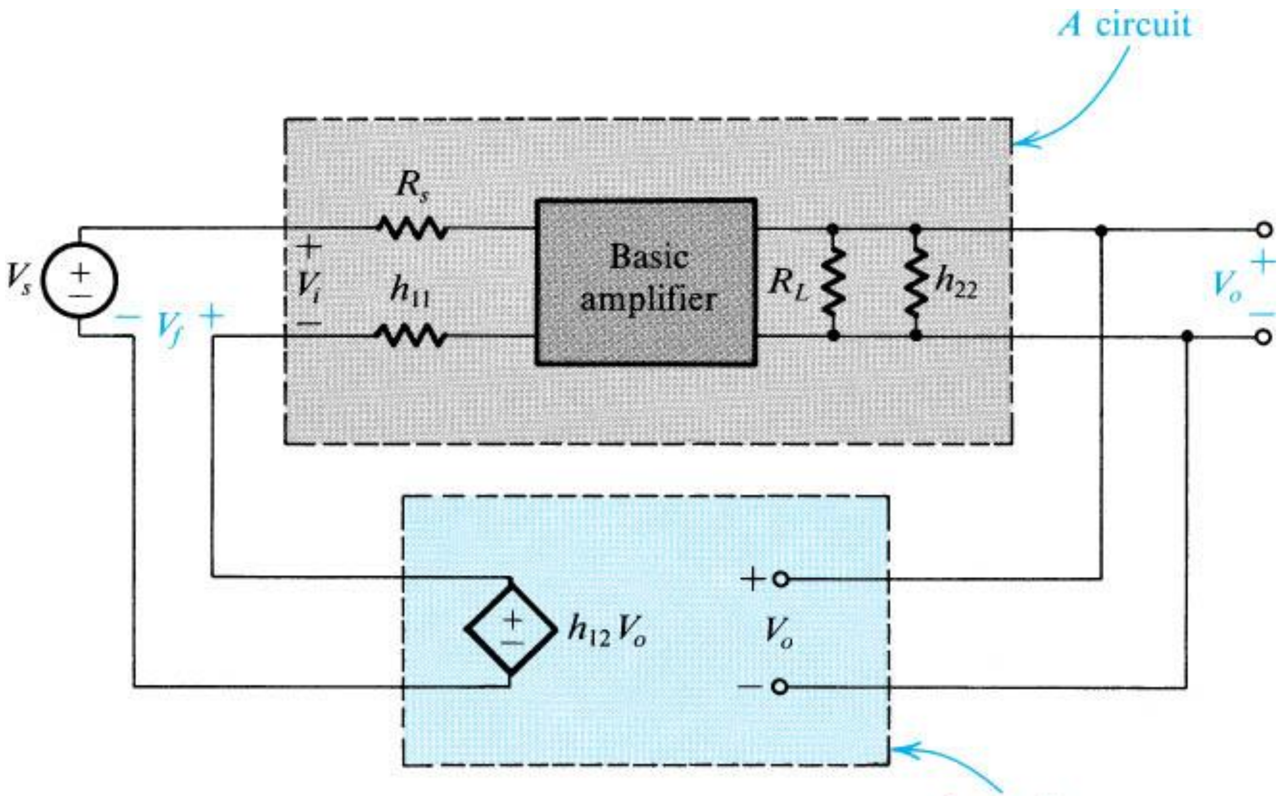
The Practical Situation



(b)

The circuit in (a) with the feedback network represented by its *h* parameters.

The Practical Situation



(c)

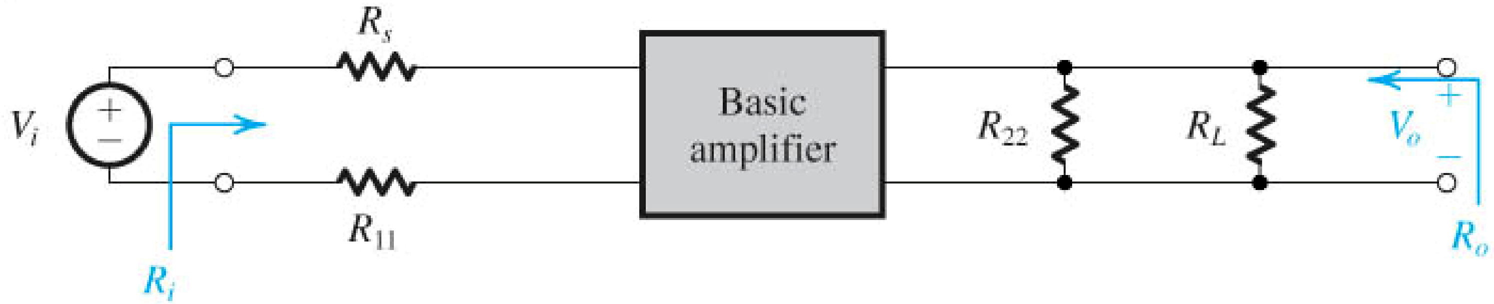
The circuit in (b) with h_{21} neglected.

The Practical Situation

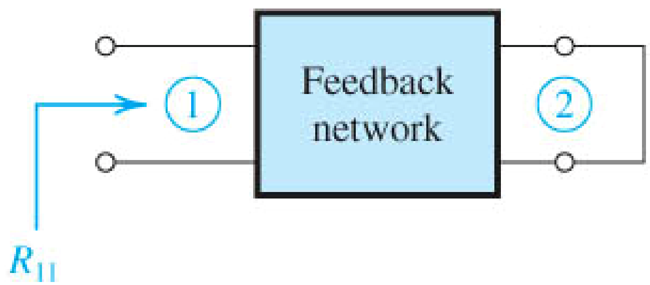
- The load effect of the feedback network on the basic amplifier is represented by the components h_{11} and h_{22}.
- The loading effect is found by looking into the appropriate port of the feedback network while the port is open-circuit or short-circuit so as to destroy the feedback.
- If the connection is a shunt one, short-circuit the port.
- If the connection is a series one, open-circuit the port.
- Determine the β.

$$\beta = h_{12} \equiv \left.\frac{V_1}{V_2}\right|_{I_1=0}$$

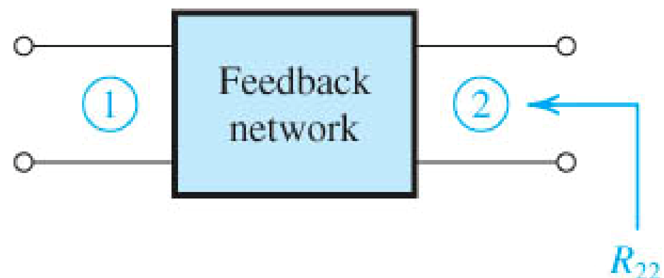
(a) The A circuit is



where R_{11} is obtained from



and R_{22} is obtained from



and the gain A is defined $A \equiv \dfrac{V_o}{V_i}$

(b) β is obtained from

$$\beta \equiv \left.\frac{V_f}{V_o}\right|_{I_1 = 0}$$

Summary

- R_i and R_o are the input and output resistances, respectively, of the A circuit.
- R_{if} and R_{of} are the input and output resistances, respectively, of the feedback amplifier, including R_s and R_L.
- The actual input and output resistances exclude R_s and R_L.

$$R_{if} = R_{in} + R_s$$

$$R_{of} = R_{out} // R_L$$