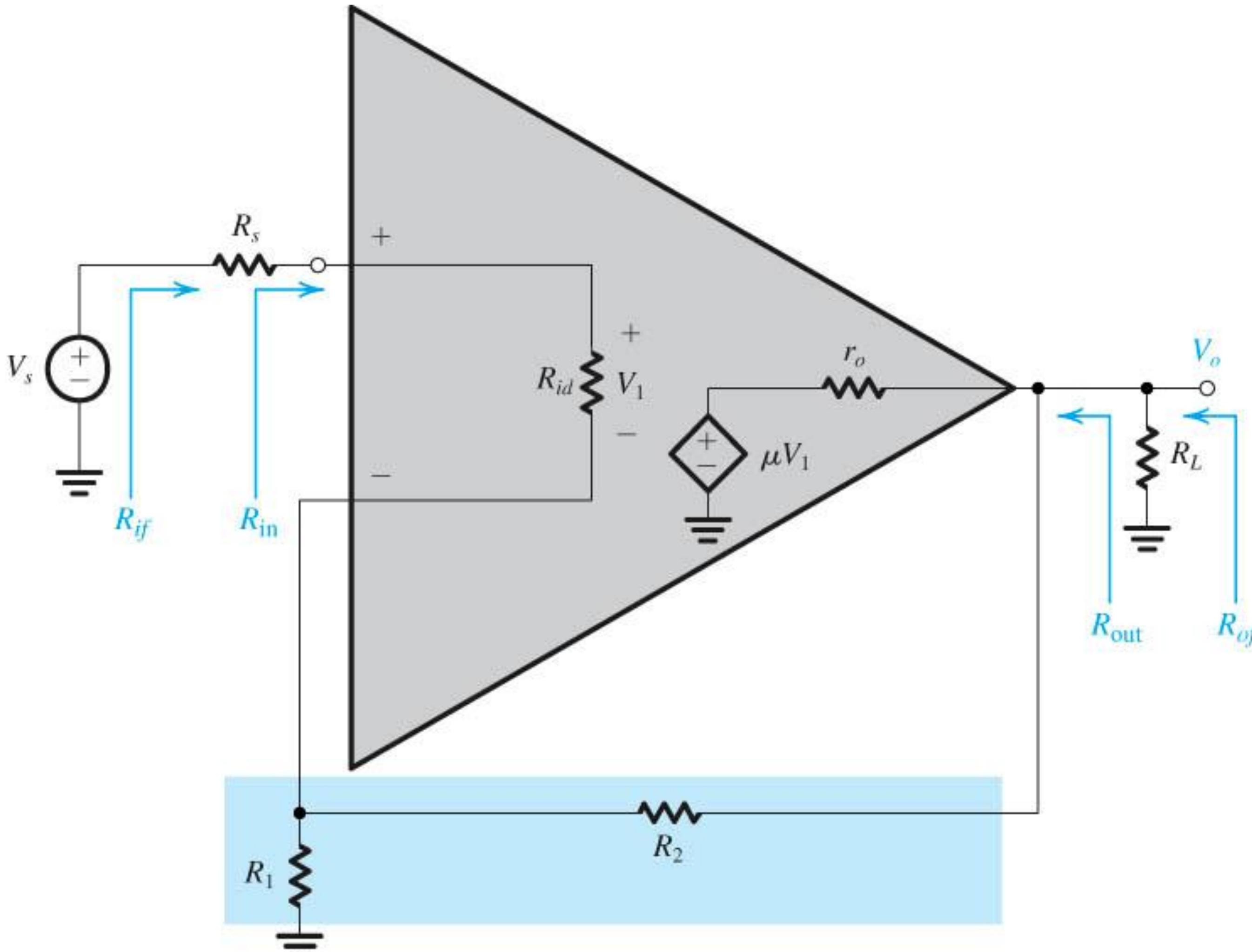
Lecture-5

Feedback Amplifier Configuration
Examples with Ideal Situation

Example of Series-Shunt Feedback Amplifier

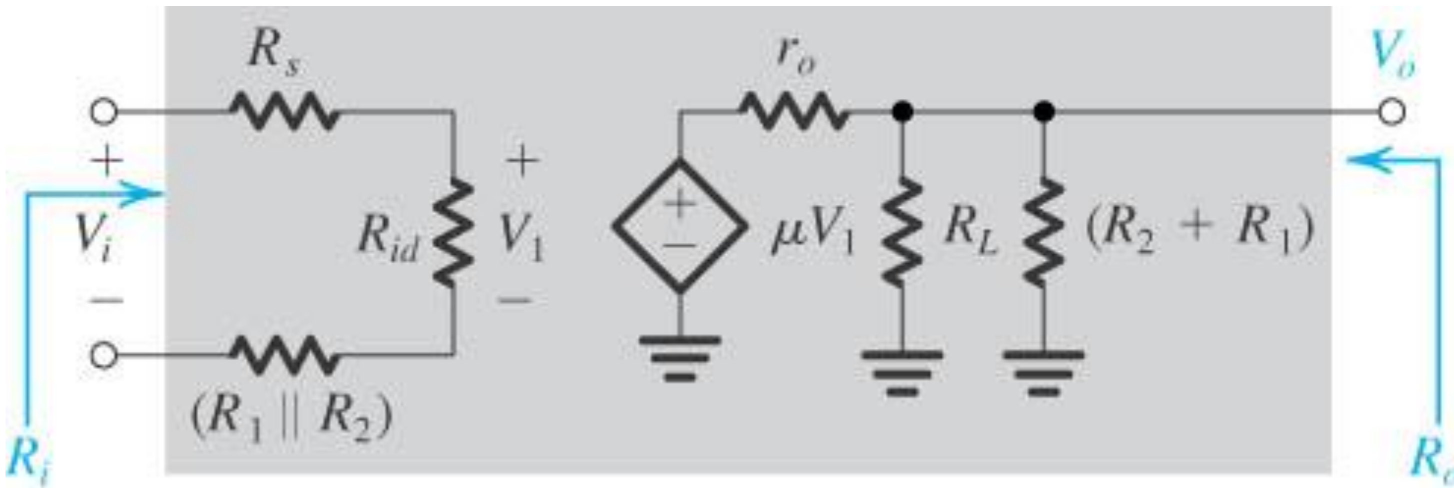


(a)

Example of Series-Shunt Feedback Amplifier

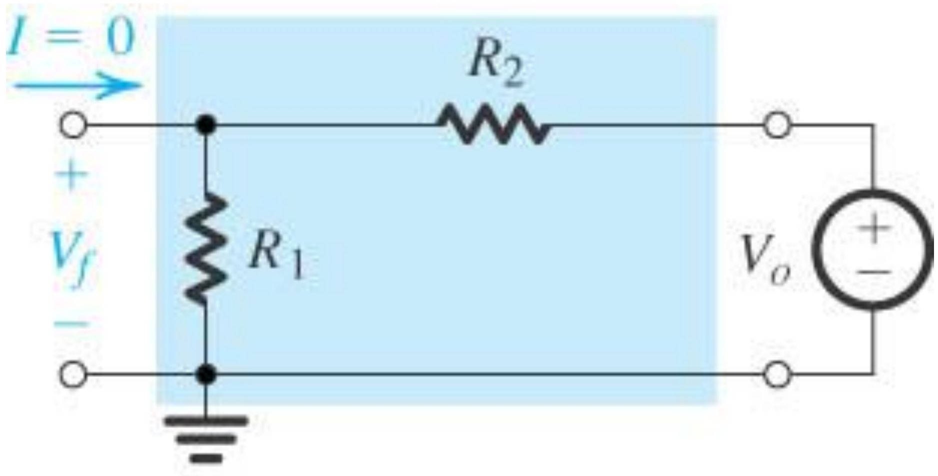
- Op amplifier connected in noninverting configuration with the open-loop gain μ, R_{id} and r_o
- Find expression for A, β, the closed-loop gain V_o/V_i, the input resistance R_{in} and the output resistance R_{out}
- Find numerical values

Example of Series-Shunt Feedback Amplifier



(b)

Example of Series-Shunt Feedback Amplifier



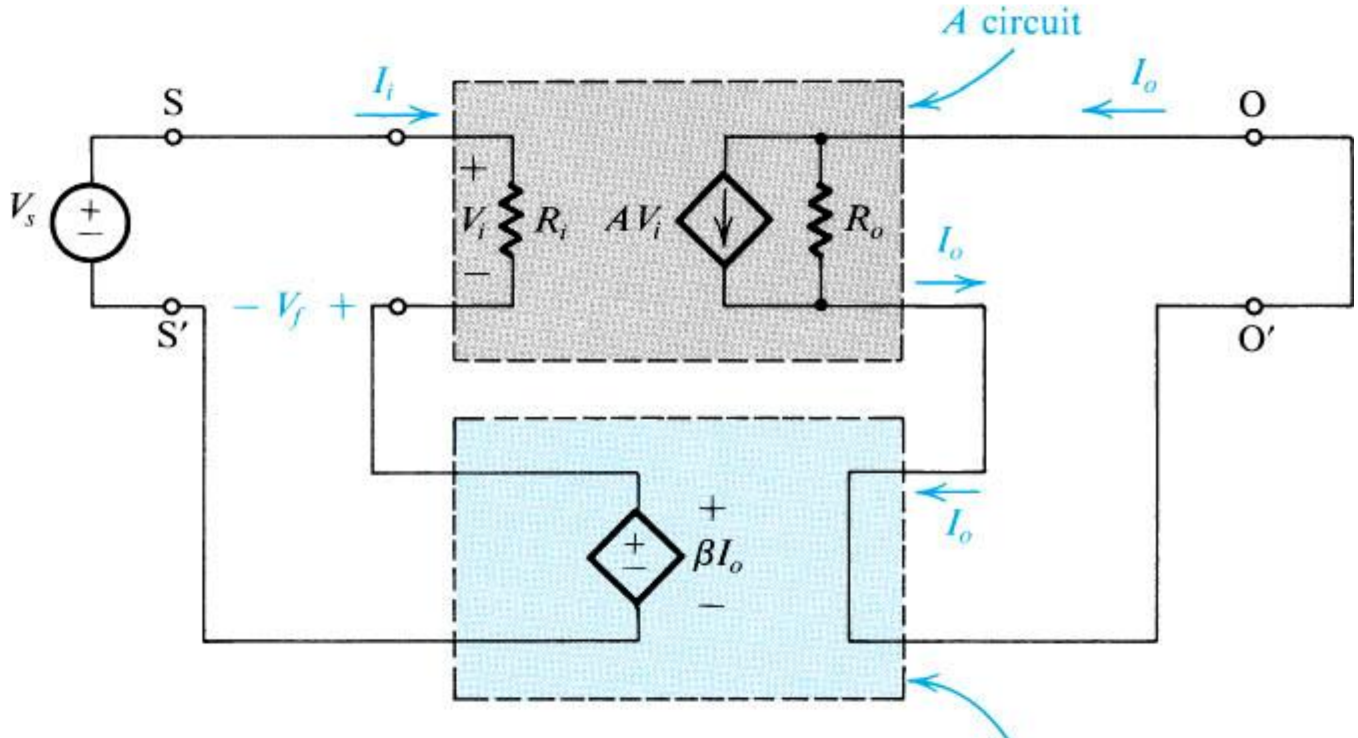
(c)

$$\beta \equiv \frac{V_f}{V_s} = \frac{R_1}{R_1 + R_2}$$

The Series-Series Feedback Amplifier

- The ideal situation
- The practical situation
- summary

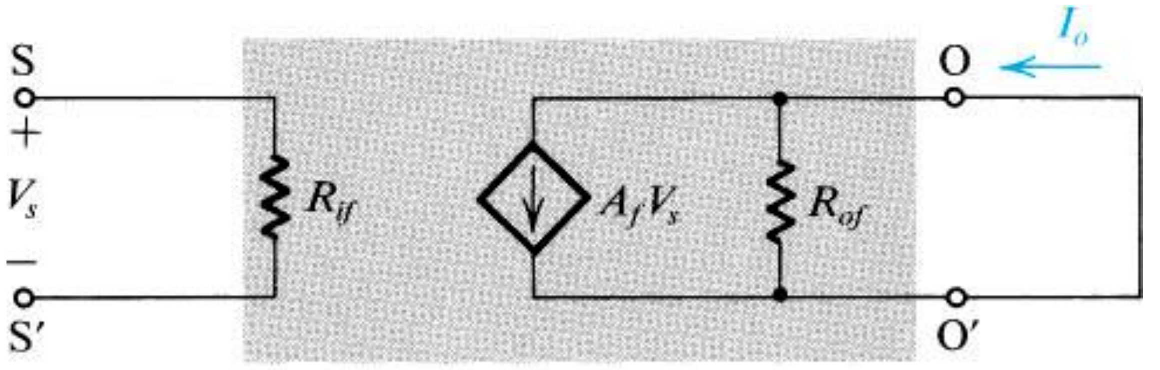
The Ideal Situation



(a)

Transconductance gain $A \equiv \dfrac{I_o}{V_i}$

The Ideal Situation



(b)

Tranresistance feedback factor $\beta \equiv \frac{V_f}{I_o}$

Input and Output Resistance with Feedback

- Input resistance

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

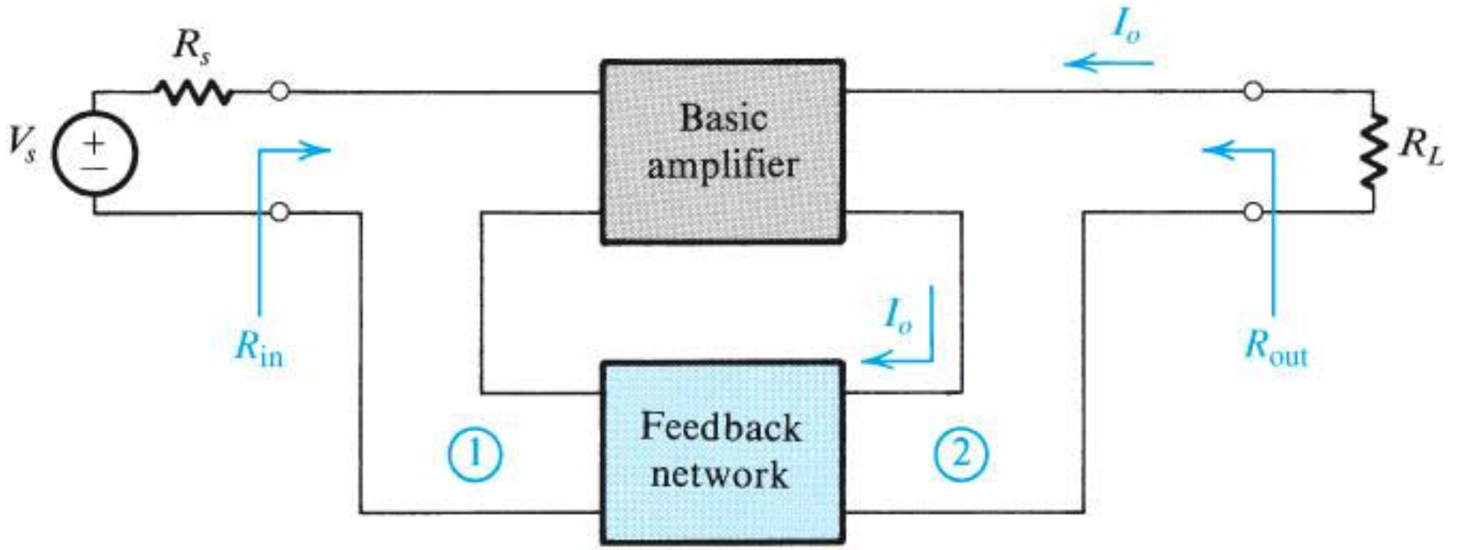
In this case, the negative feedback increases the input resistance by a factor equal to the amount of feedback.

- Output resistance

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

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

The Practical Situation

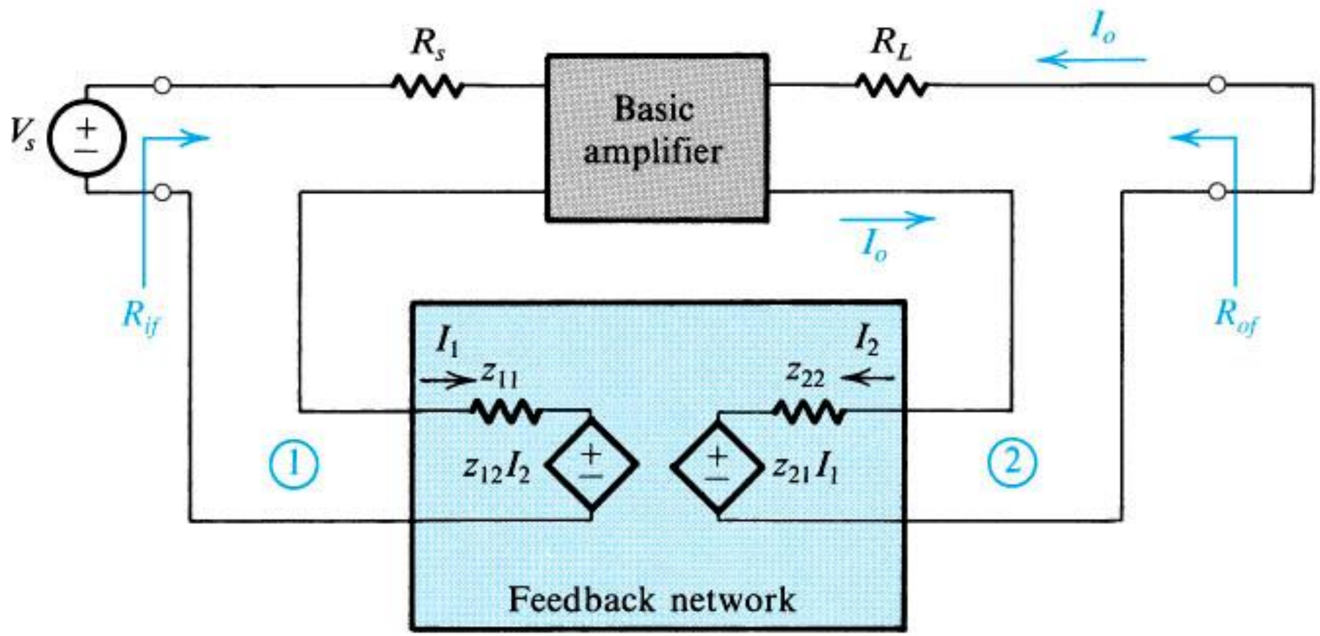


(a)

Block diagram of a practical series–series feedback amplifier.

Feedback network is not ideal and load the basic amplifier thus affect the values of gain, input resistance and output resistance.

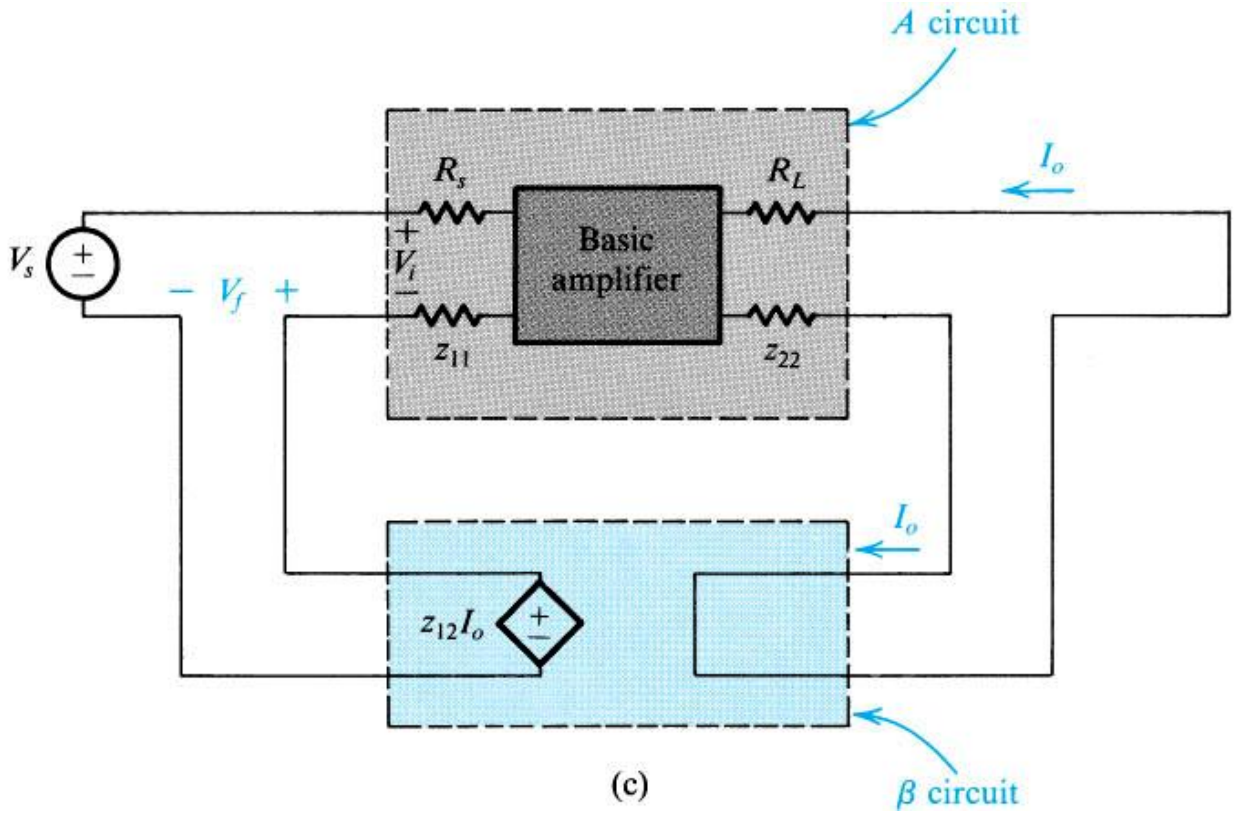
The Practical Situation



(b)

The circuit of (a) with the feedback network represented by its *z* parameters.

The Practical Situation

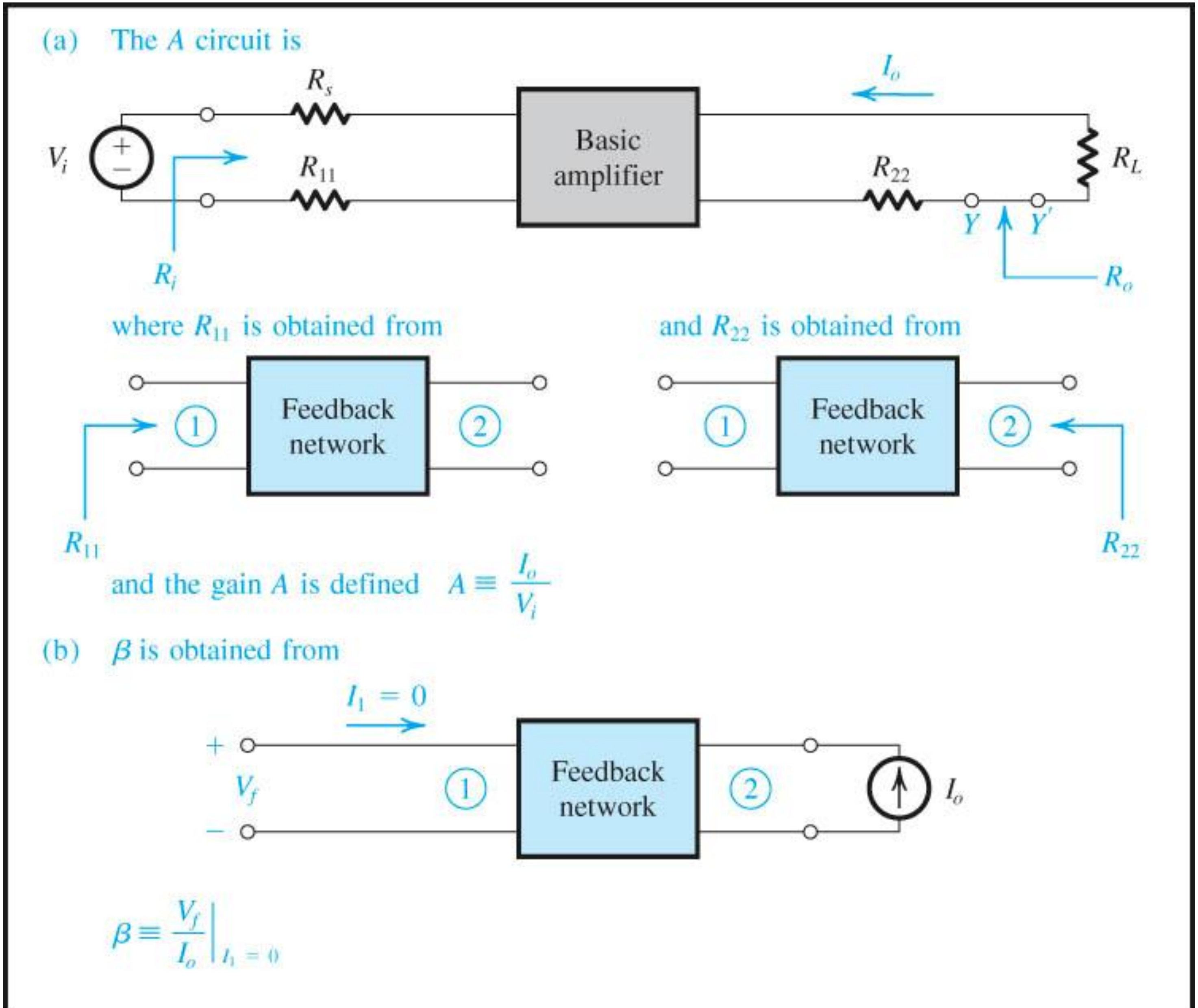


A redrawing of the circuit in (b) with z_{21} neglected.

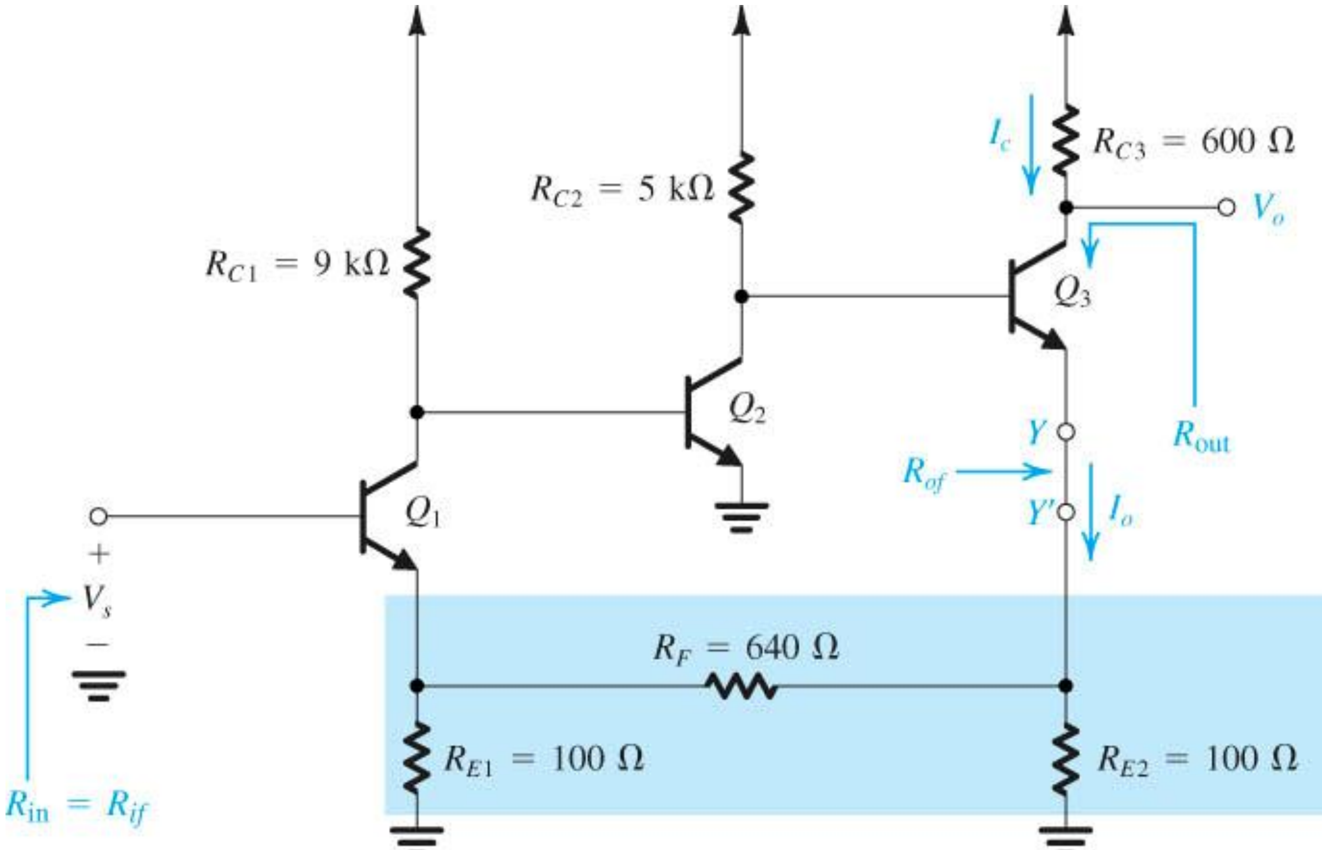
The Practical Situation

- The load effect of the feedback network on the basic amplifier is represented by the components Z_{11} and Z_{22}.
- Z_{11} is the impedance looking into port 1 of the feedback network with port 2 open-circuited.
- Z_{22} is the impedance looking into port 2 of the feedback network with port 1 open-circuited.
- Determine the β.

$$\beta = z_{12} \equiv \left.\frac{V_1}{I_2}\right|_{I_1=0}$$

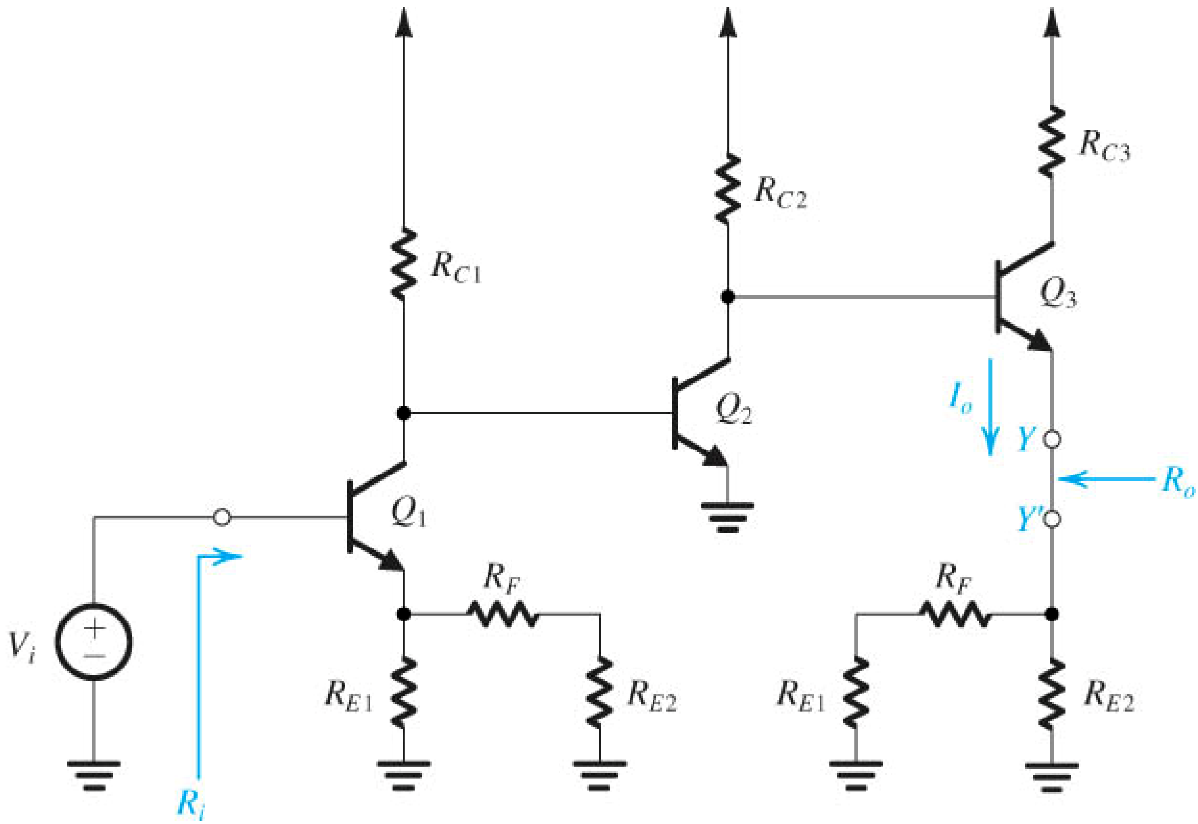

(a) The A circuit is
R_s
I_o
V_i
Basic amplifier
R_{11}
R_{22}
R_L
Y
Y'
R_i
R_o
where R_{11} is obtained from
and R_{22} is obtained from
Feedback network
1
2
R_{11}
R_{22}
and the gain A is defined $A \equiv \frac{I_o}{V_i}$
(b) β is obtained from
$I_1 = 0$
V_f
I_o
$\beta \equiv \left. \frac{V_f}{I_o} \right|_{I_1 = 0}$

Example of Series-Series Feedback Amplifier



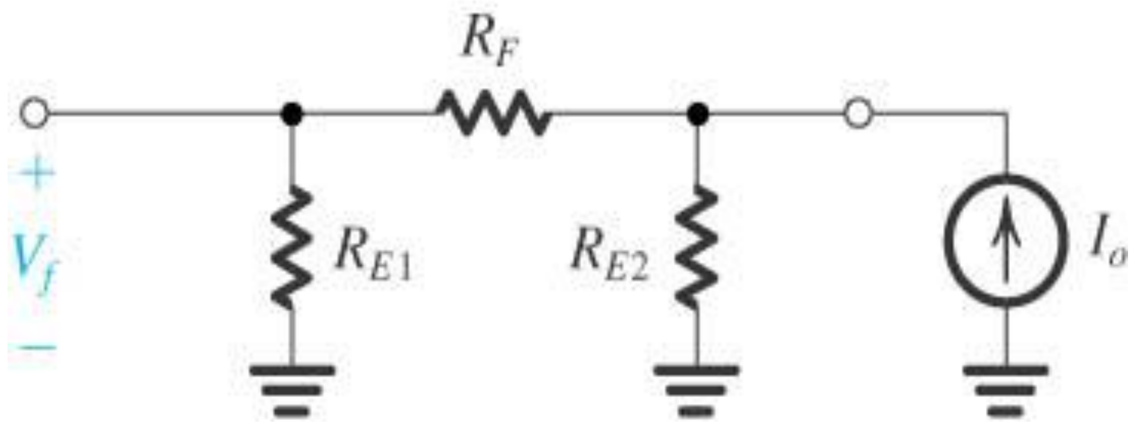
(a)

Example of Series-Series Feedback Amplifier



(b)

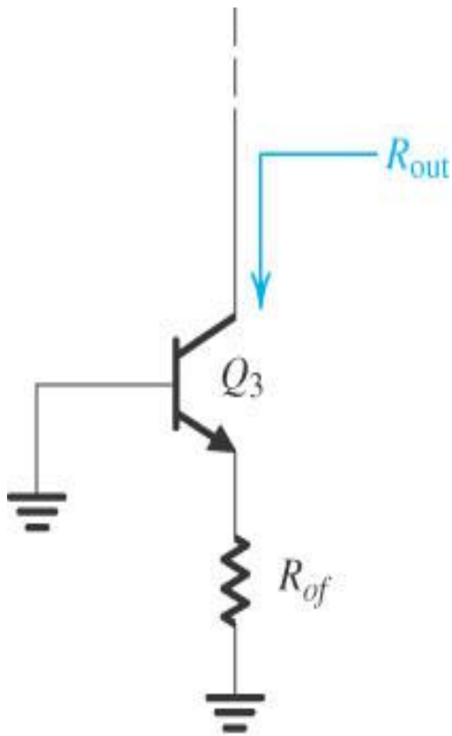
Example of Series-Series Feedback Amplifier



(c)

$$\beta \equiv \frac{V_f}{I_o} = \frac{R_{E2}}{R_{E2} + R_F + R_{E1}} \times R_{E1}$$

Example of Series-Series Feedback Amplifier



(d)

$$R_o = \left[R_{E2} // (R_F + R_{E1})\right] + r_{e3} + \frac{R_{C2}}{1 + h_{fe}}$$

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

$$R_{out} = r_o + (1 + g_{m3} r_o)(R_{of} // r_{\pi 3})$$