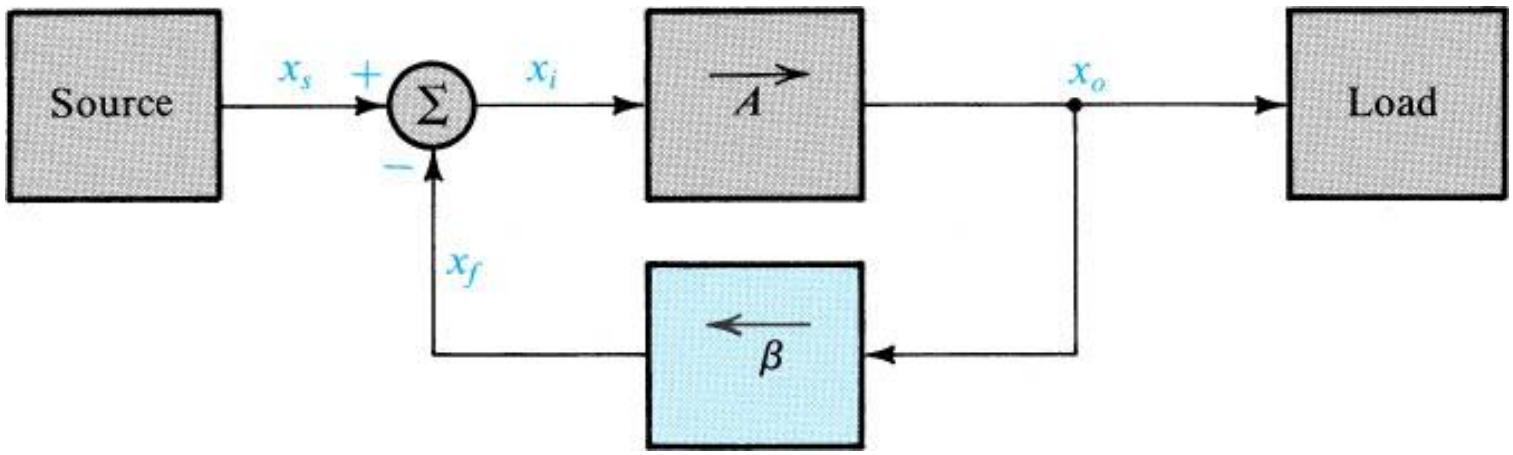
Lecture-3

Feedback Amplifier and their Topologies

Introduction

- It's impossible to think of electronic circuits without some forms of feedback.
- Negative feedback
  - Desensitize the gain
  - Reduce nonlinear distortion
  - Reduce the effect of noise
  - Control the input and output impedance
  - Extend the bandwidth of the amplifier
- *The basic idea of negative feedback is to trade off gain for other desirable properties.*
- Positive feedback will cause the amplifier oscillation.

The General Feedback Structure



This is a signal-flow diagram, and the quantities *x* represent either voltage or current signals.

The General Feedback Equation

- Closed loop and open loop
- Closed loop gain

$$A_f \equiv \frac{x_o}{x_s} = \frac{A}{1 + A\beta}$$

- Feedback factor β
- Loop gain Aβ
- Amount of feedback (1+ Aβ)

Some Properties of Negative Feedback

- Gain desensitivity

$$\frac{dA_f}{A_f} = \frac{1}{1+A\beta}\frac{dA}{A}$$

- Bandwidth extension
- Noise reduction
- Reduction in nonlinear distortion

The Four Basic Feedback Topologies

- Voltage amplifier---series-shunt feedback

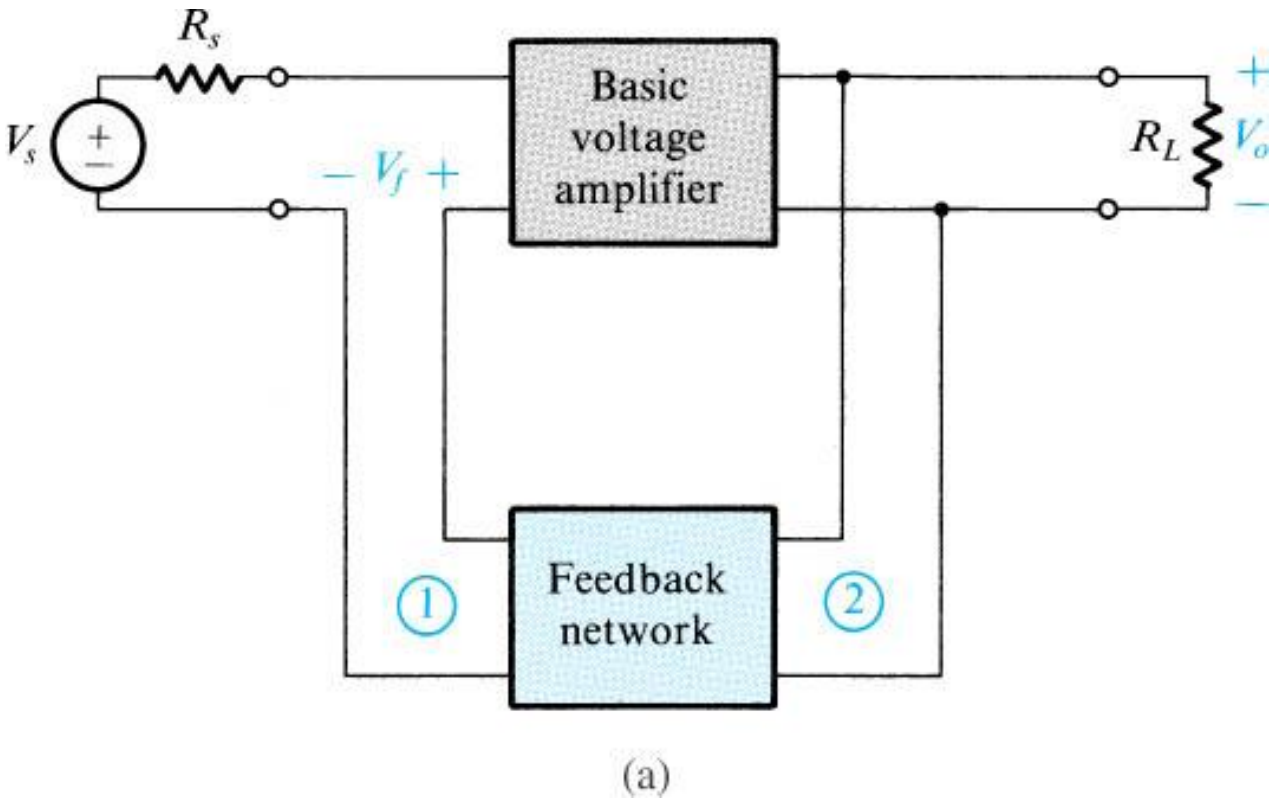
  voltage mixing and voltage sampling
- Current amplifier---shunt-series feedback

  Current mixing and current sampling
- Transconducatnce amplifier---series-series feedback

  Voltage mixing and current sampling
- Transresistance amplifier---shunt-shunt feedback

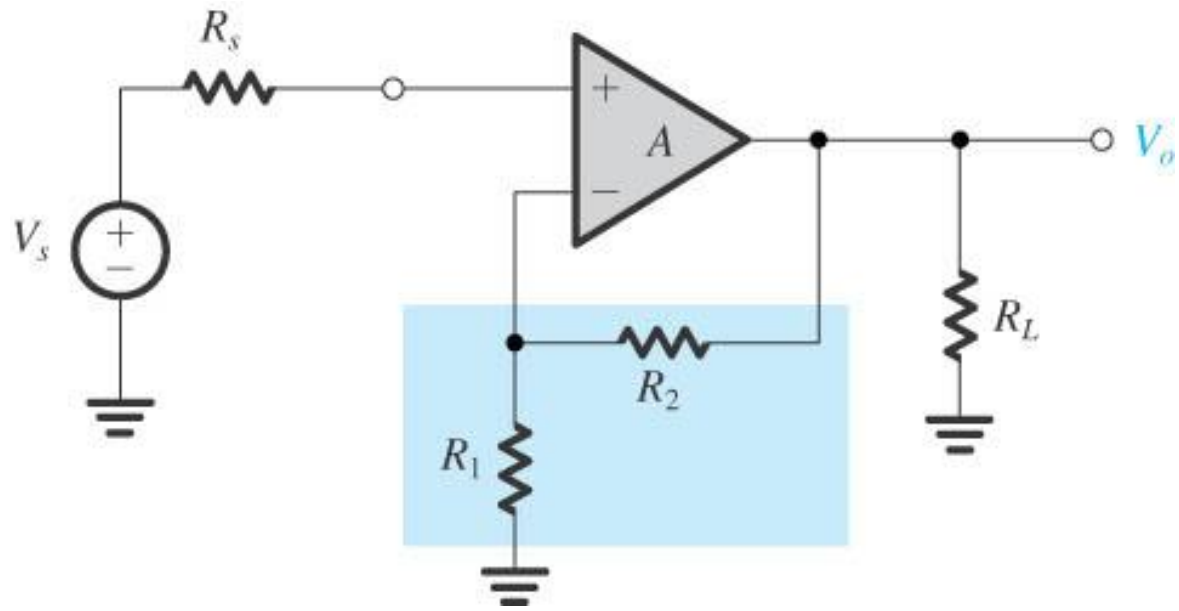
  Current mixing and voltage sampling

The Series-Shunt Feedback Topologies



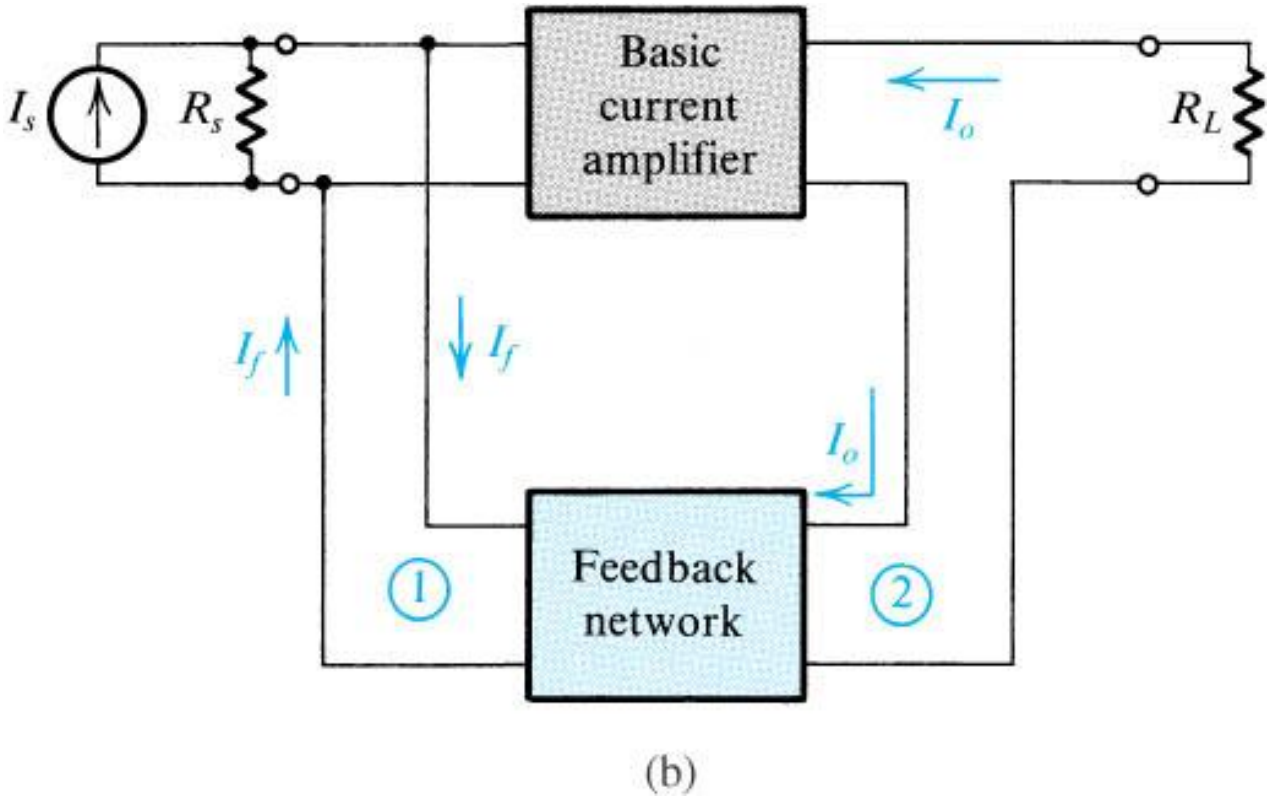
voltage-mixing voltage-sampling (series–shunt) topology

The Amplifier with Series-Shunt Feedback



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

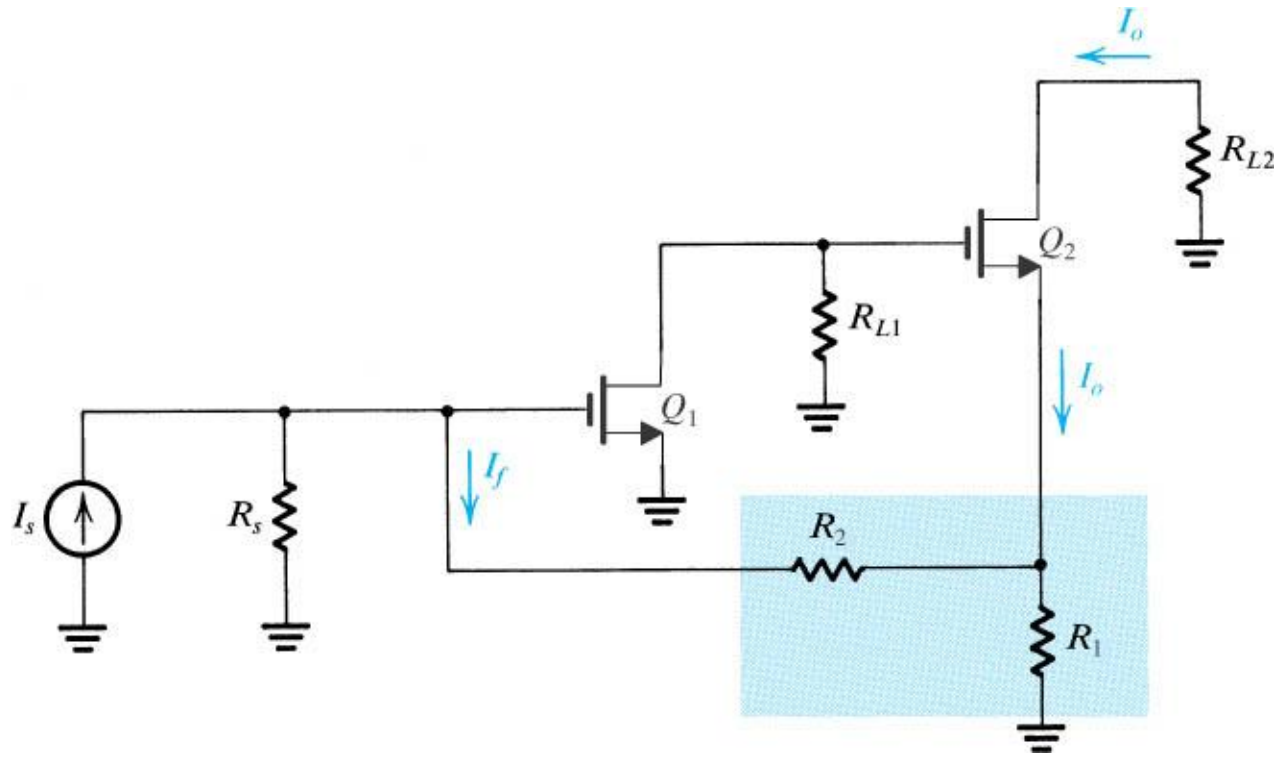
The Shunt-Series Feedback Topologies



(b)

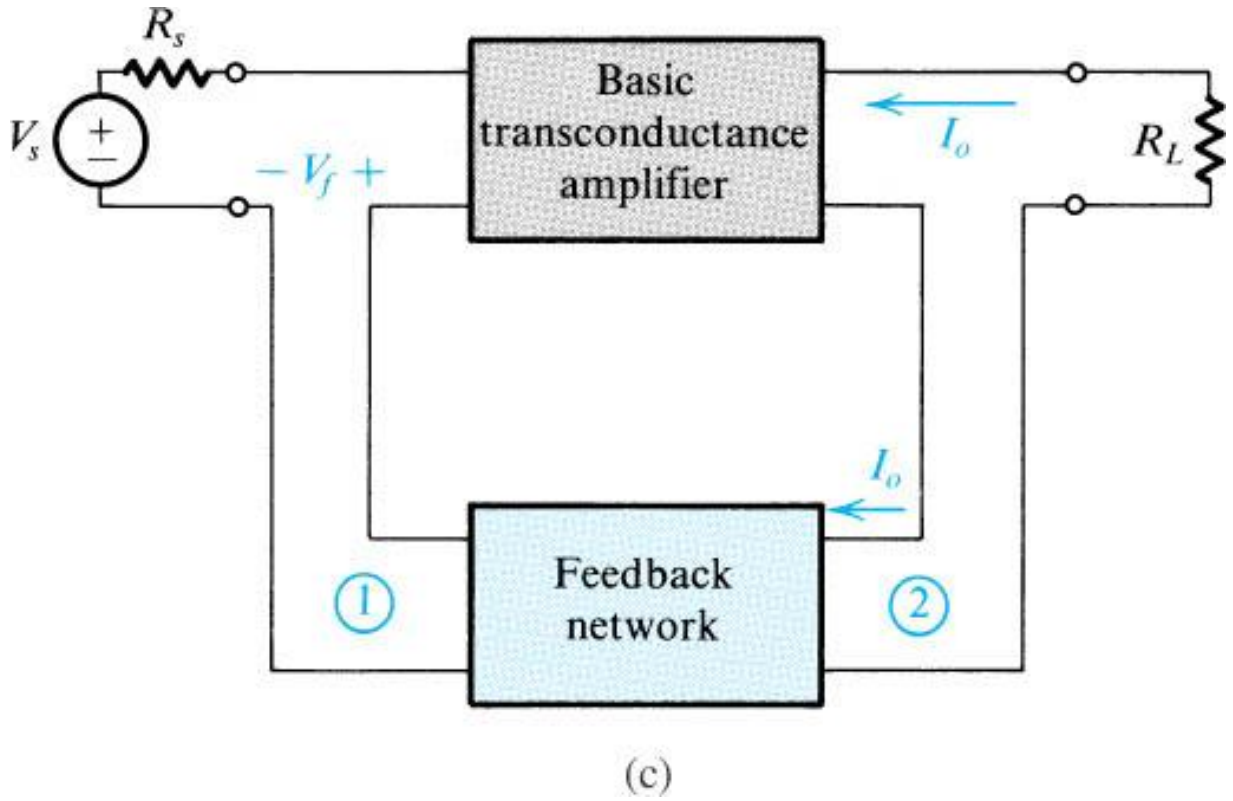
current-mixing current-sampling (shunt–series) topology

The Amplifier with Shunt-Series Feedback



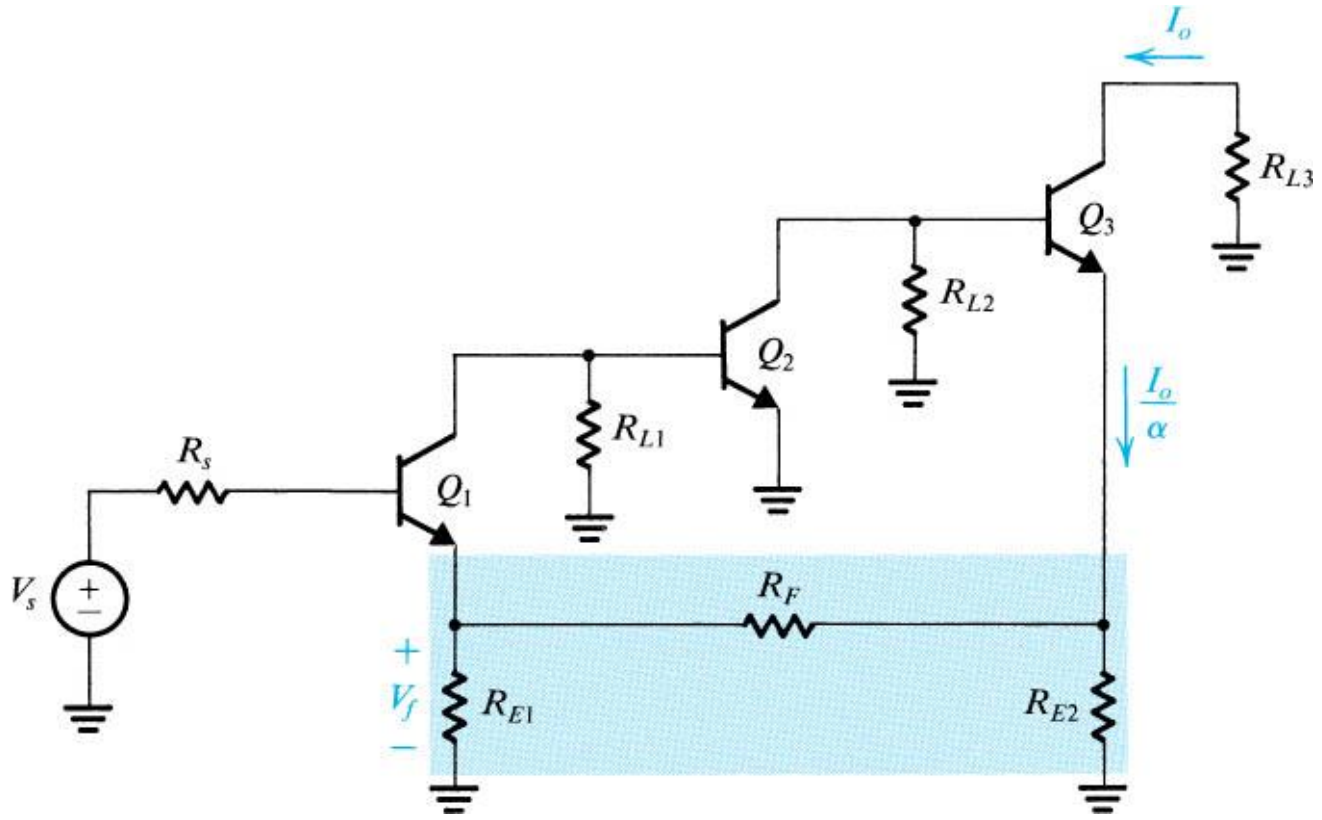
current-mixing current-sampling (shunt–series) topology

The Series-Series Feedback Topologies



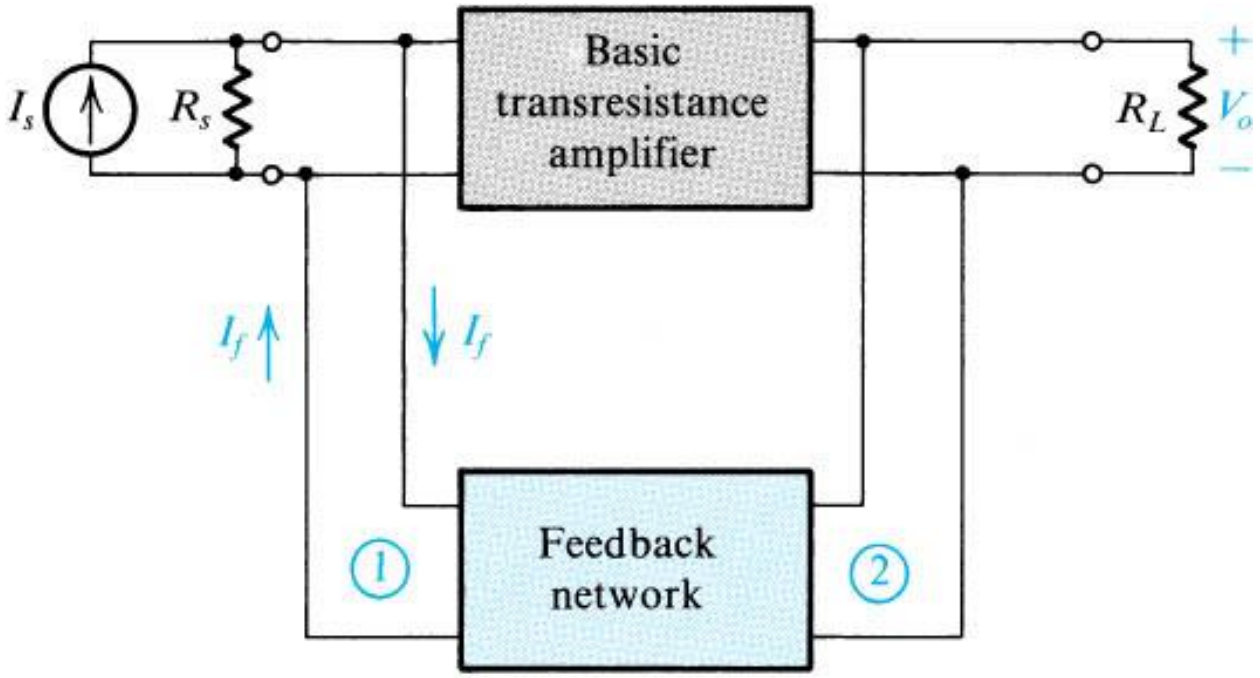
voltage-mixing current-sampling (series–series) topology

The Amplifier with Series-Series Feedback



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

The Shunt-Shunt Feedback Topologies



(d)

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