IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Microelectronics: Devices to Circuits

Basic Feedback Topologies

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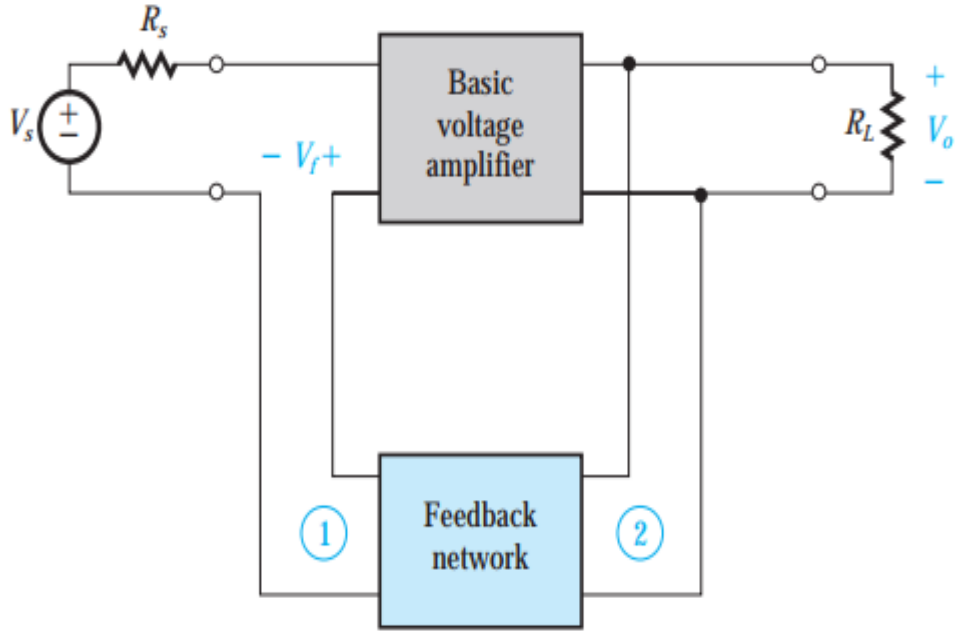
Outline

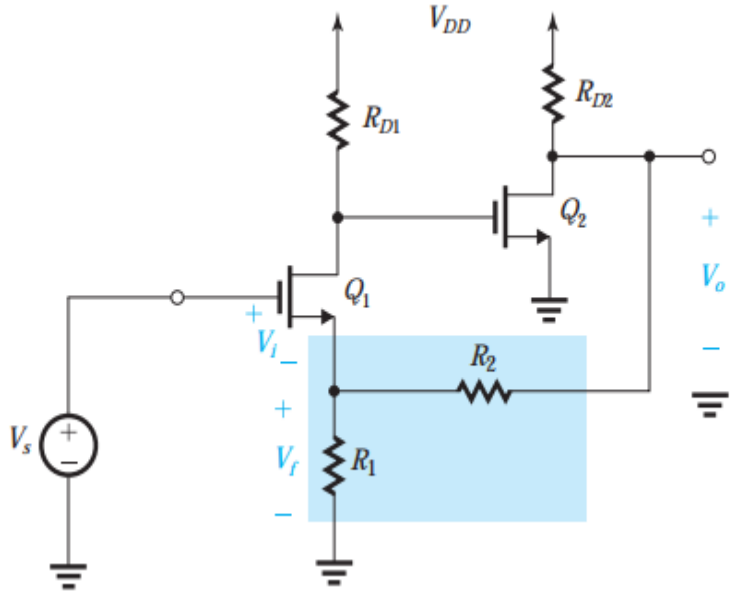
- Voltage amplifier
- Current amplifier
- Transconductance amplifier
- Transresistance amplifier
- Recapitulation

Voltage amplifier

- Voltage amplifiers are intended to amplify an input voltage signal and provide an output voltage signal.
- The voltage amplifier is essentially a voltage-controlled voltage source.
- The input resistance is required to be high, and the output resistance is required to be low.
- In a voltage amplifier, the output quantity of interest is the output voltage.
- The signal source is essentially a voltage source, it is convenient to represent it in terms of a Thévenin equivalent circuit.

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition





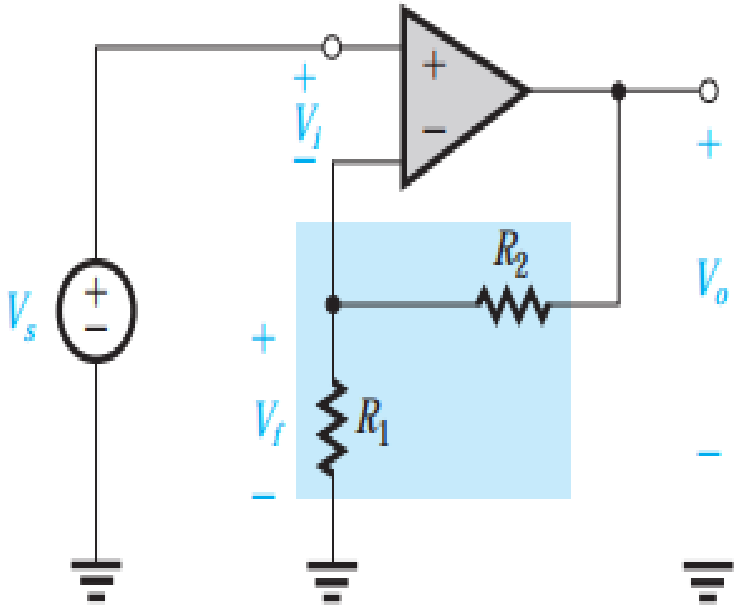
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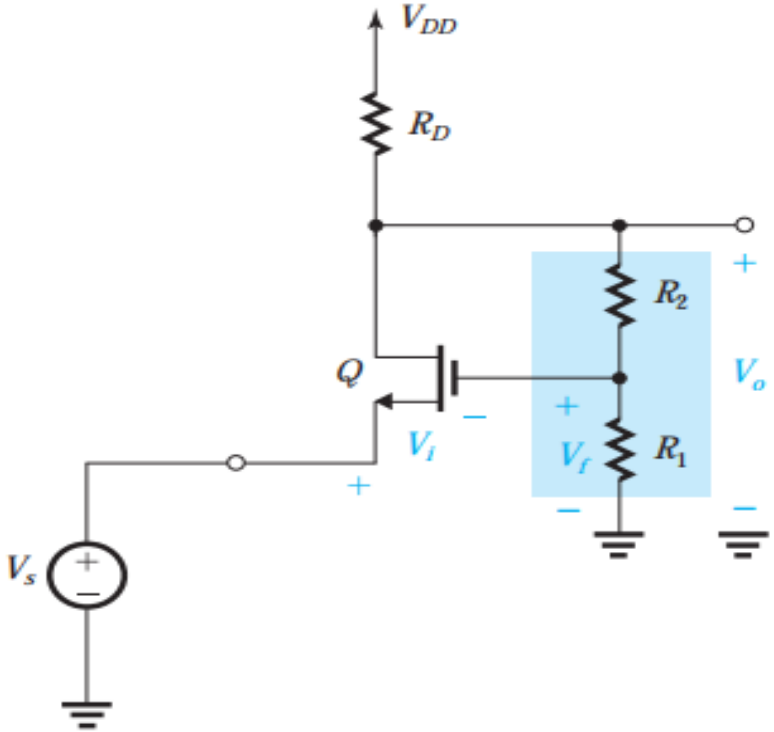
❑The most suitable feedback topology for the voltage amplifier is the voltage-mixing and voltage-sampling.

❑ Because of the series connection at the input and the parallel or shunt connection at the output, this feedback topology is also known as series–shunt feedback.

❑ This topology not only stabilizes the voltage gain but also results in a higher input resistance (intuitively, a result of the series connection at the input) and a lower output resistance(intuitively, a result of the parallel connection at the output).

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition





Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

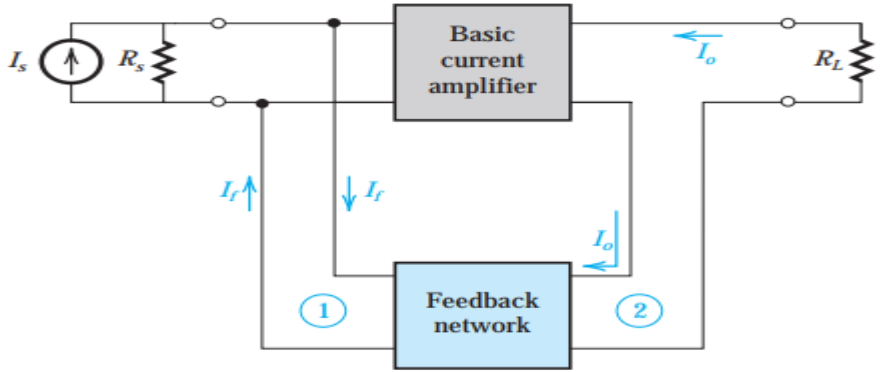
Current amplifier

- The input signal in a current amplifier is essentially a current, and thus the signal source is most conveniently represented by its Norton equivalent.
- The output quantity of interest is current, hence the feedback network should sample the output current, just as a current meter measures a current.
- The feedback signal should be in current form so that it may be mixed in shunt with the source current.
- This feedback topology most suitable for a current amplifier is the current-mixing, current-sampling topology.

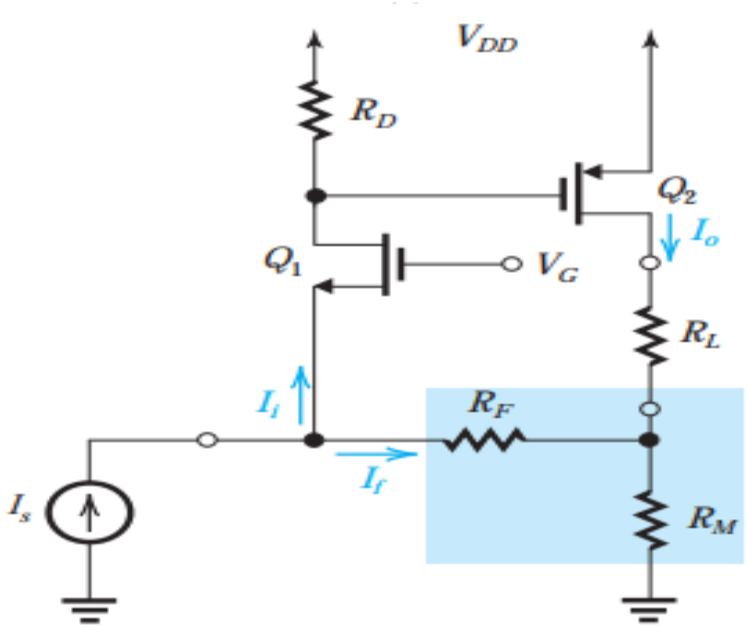
Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

❑Because of the parallel (or shunt) connection at the input, and the series connection at the output, this feedback topology is also known as shunt–series feedback.

❑ This topology not only stabilizes the current gain but also results in a lower input resistance, and a higher output resistance, both desirable properties for a current amplifier.



Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

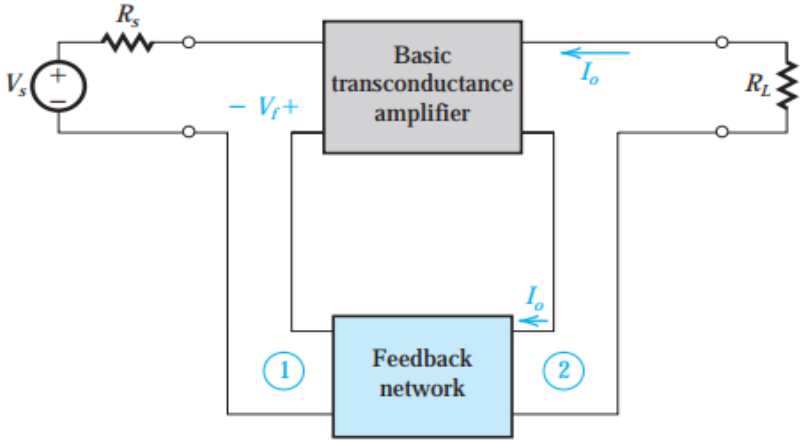


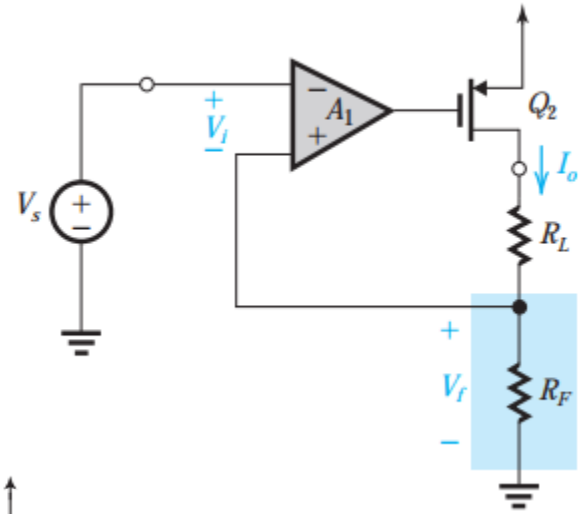
Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

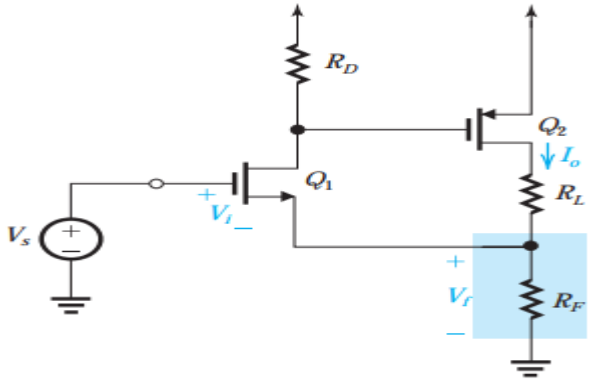
Transconductance amplifier

- In transconductance amplifiers the input signal is a voltage and the output signal is a current.
- It follows that the appropriate feedback topology is the voltage-mixing, current-sampling topology.
- The presence of the series connection at both the input and the output gives this feedback topology the alternative name series -series feedback.
- The series–series feedback topology provides the transconductance amplifier with the desirable properties of increased input and output resistance

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition





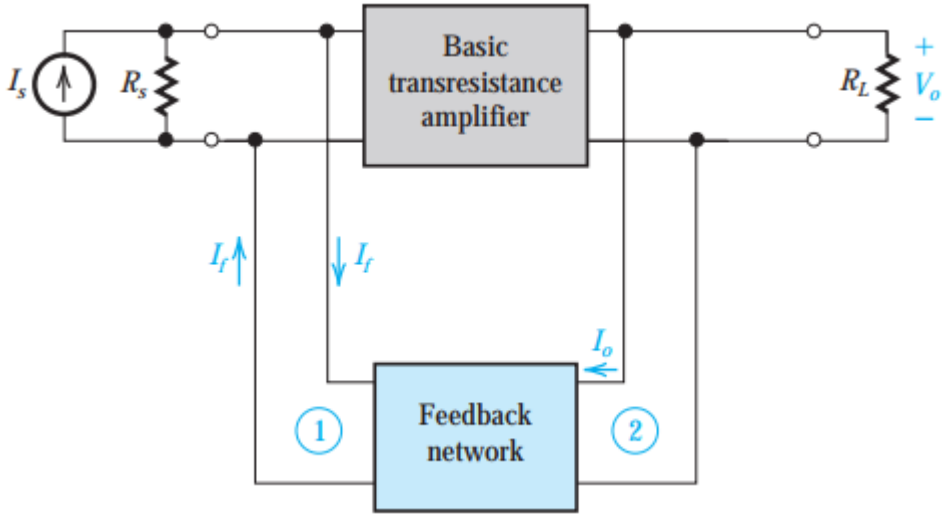


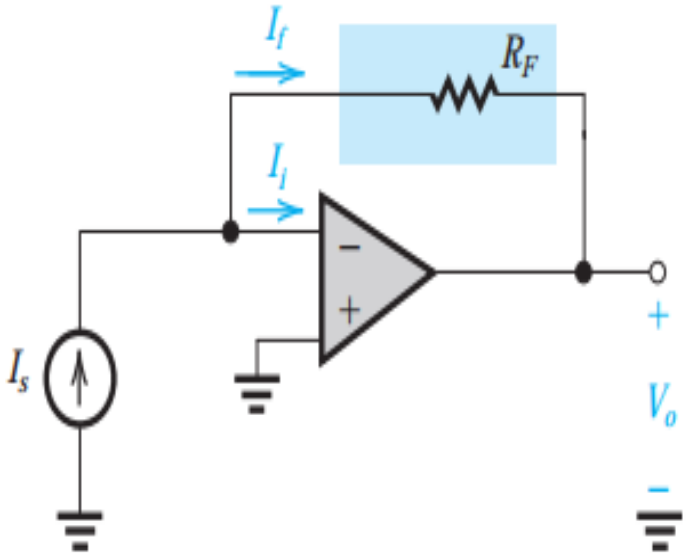
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Transresistance amplifier

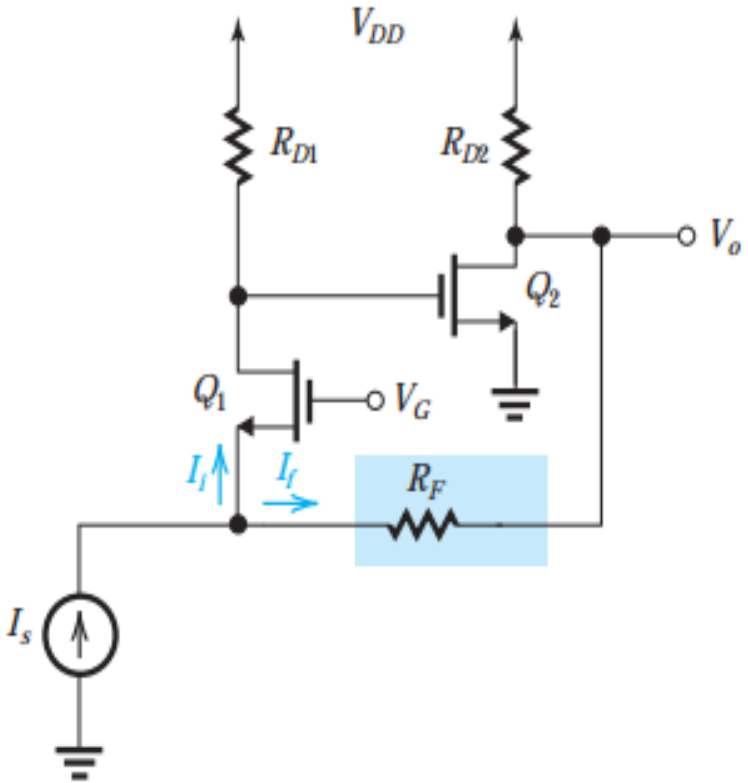
- In transresistance amplifiers the input signal is current and the output signal is voltage.
- It follows that the appropriate feedback topology is of the current-mixing, voltage sampling type.
- The presence of the parallel (or shunt) connection at both the input and the output makes this feedback topology also known as shunt–shunt feedback.
- The shunt–shunt topology equips the transresistance amplifier with the desirable attributes of a low input and a low output resistance

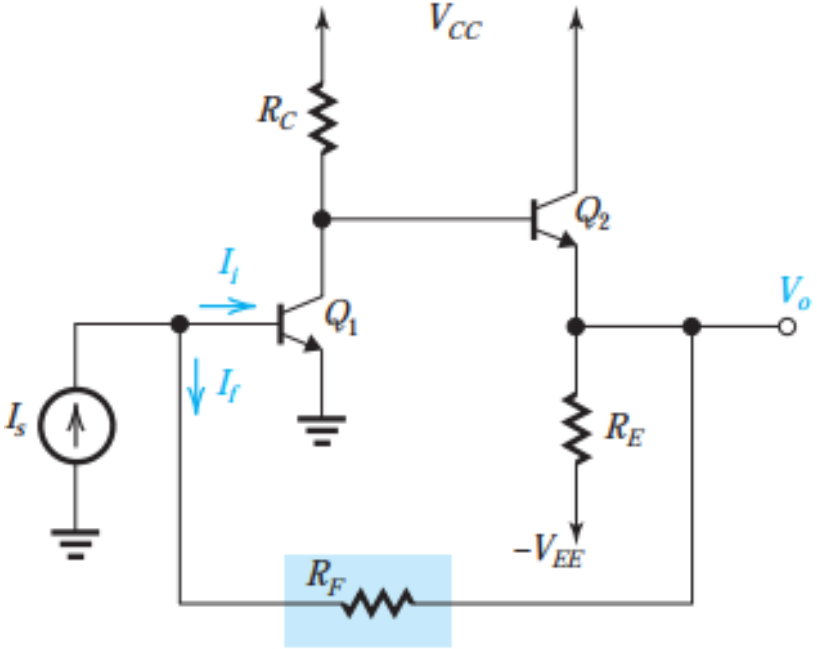
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Recapitulation

- For β calculation, we assume that the input resistance of the closed-loop amplifier was very low.
- We assumed that $(R_1+R_2) >> R_D$ is, that the feedback network does not load the basic amplifier.

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

Thank You