

# **Structured Electronic Design**

## Negative Feedback Amplifiers with OpAmp Controllers

*Anton J.M. Montagne*

# Wrap-up

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## 1. Amplifier types

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  - a. Nine unilateral types

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  - b. Six non unilateral types

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  - c. Five port isolation configurations for each type

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2. All types can be realized with controllers that behave as natural two ports and transformers and gyrators as feedback elements

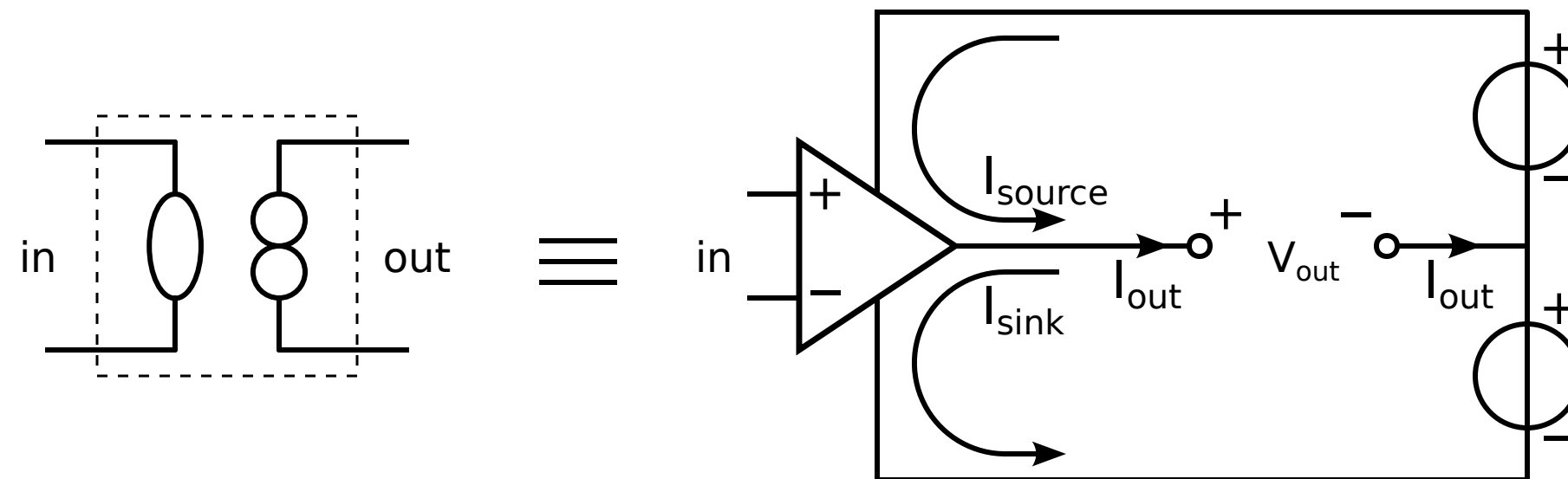
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3. The operational amplifier does not behave as a natural two port:



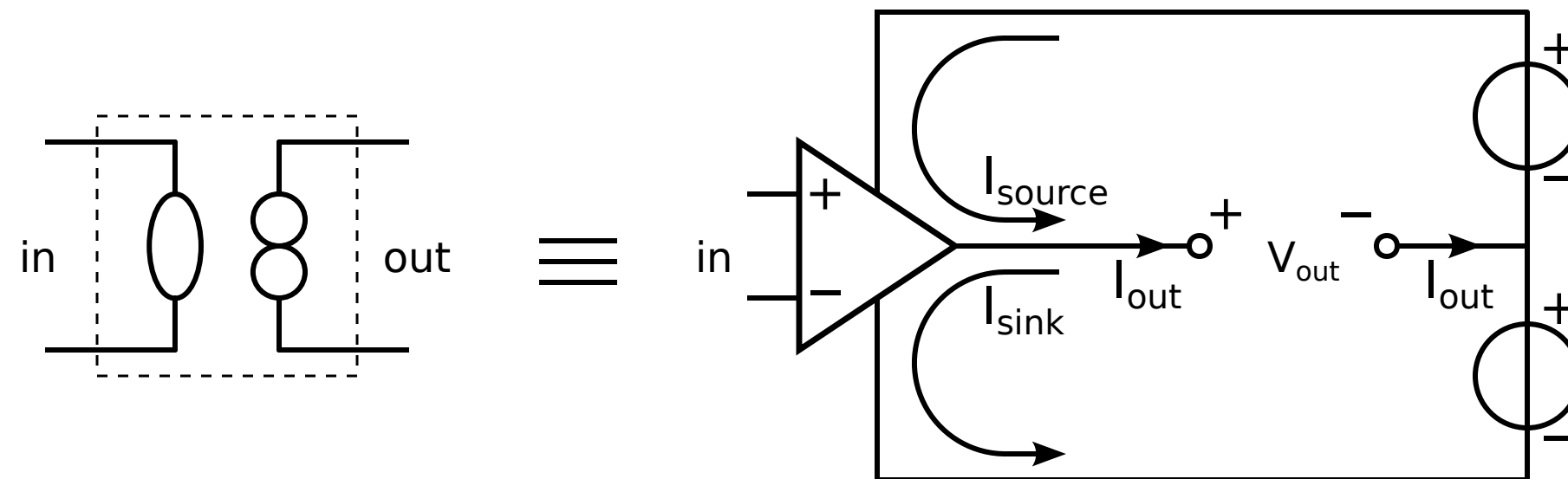
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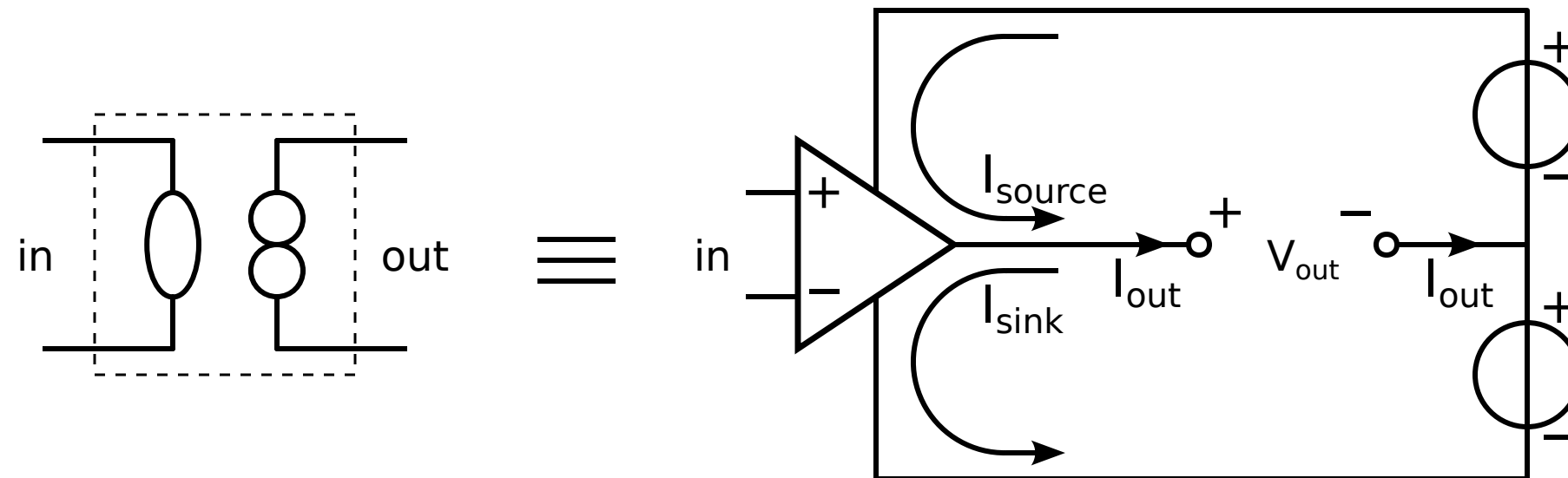
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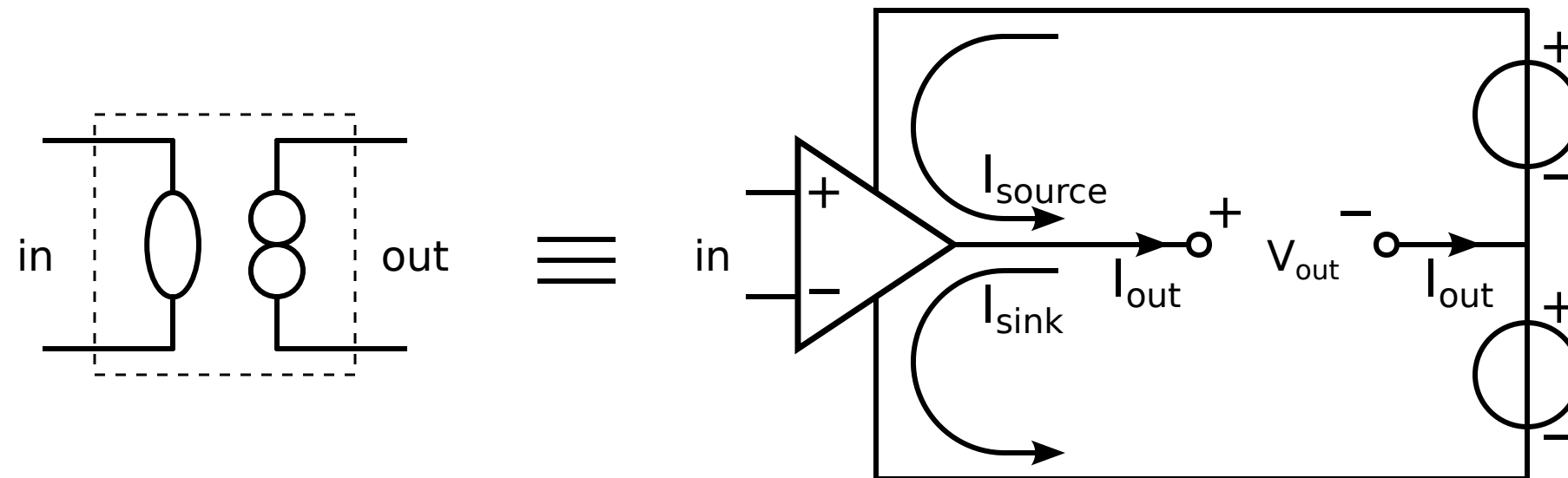
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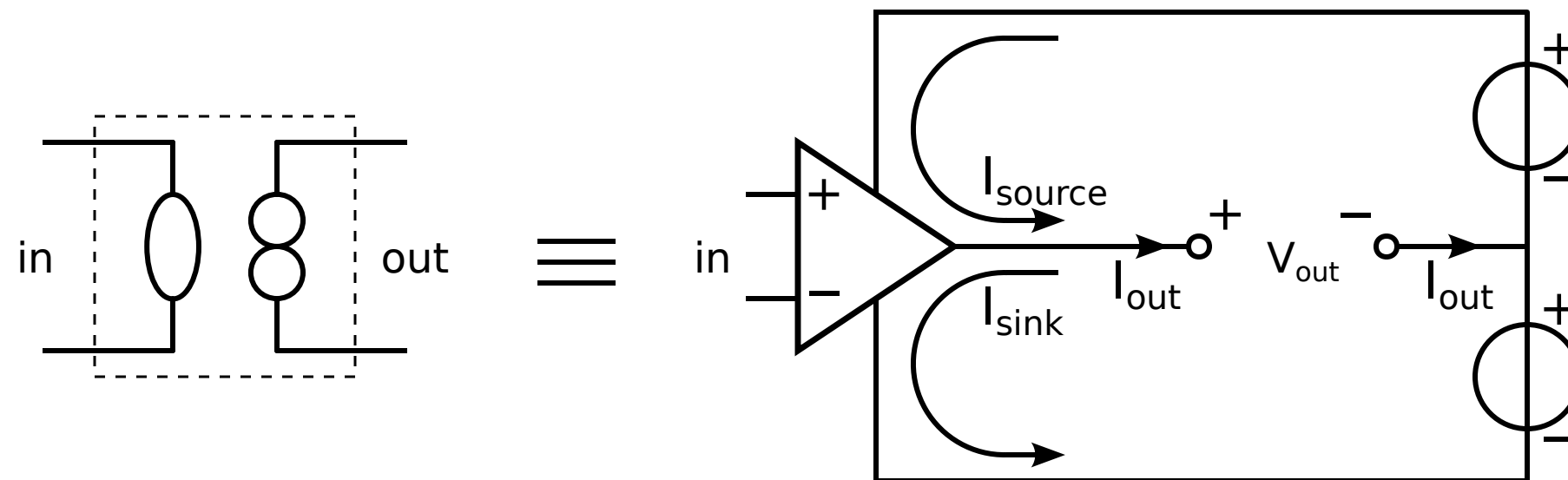
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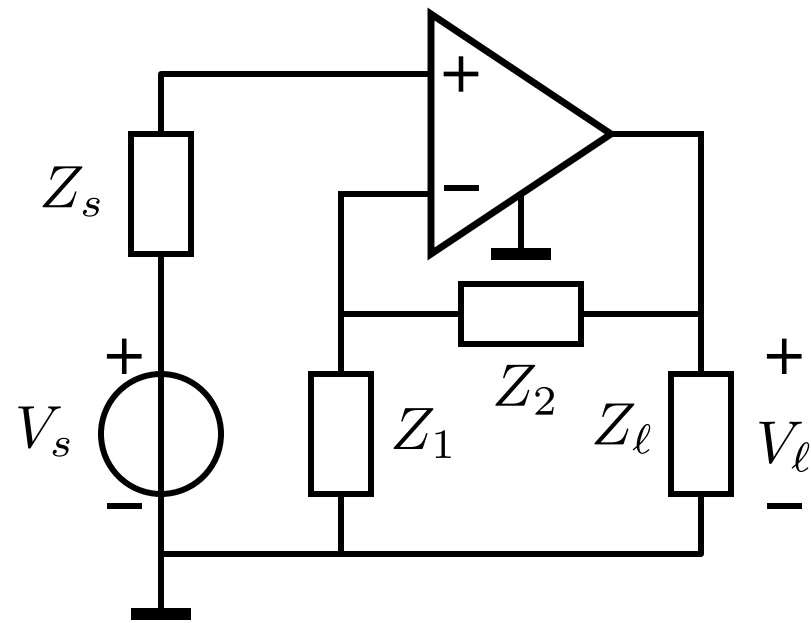
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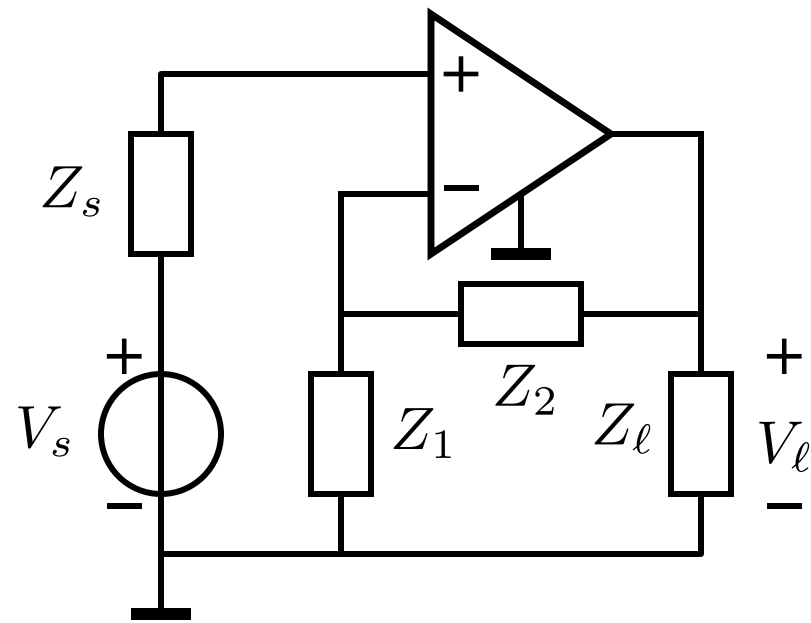
# Single-loop passive feedback configurations

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Non-inverting  
voltage amplifier

# Single-loop passive feedback configurations

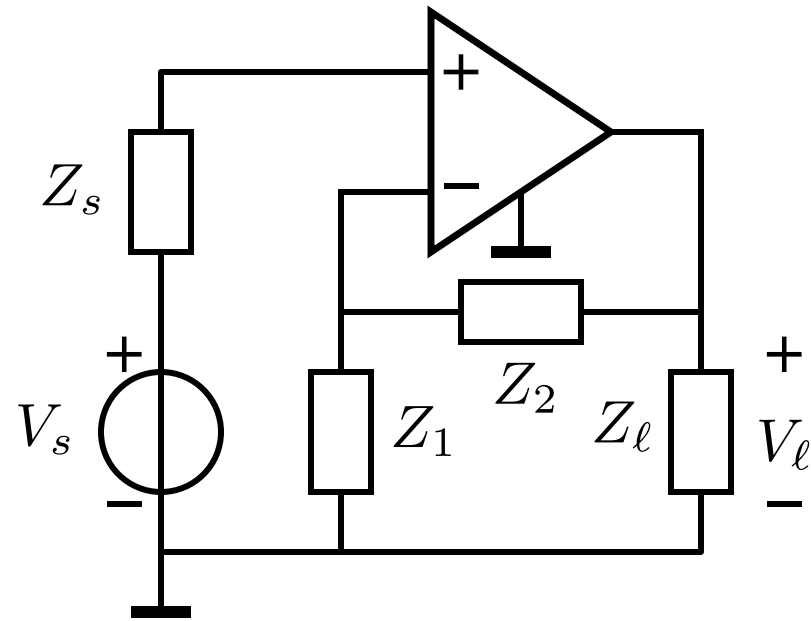


Non-inverting  
voltage amplifier

- Grounded source
- Grounded load

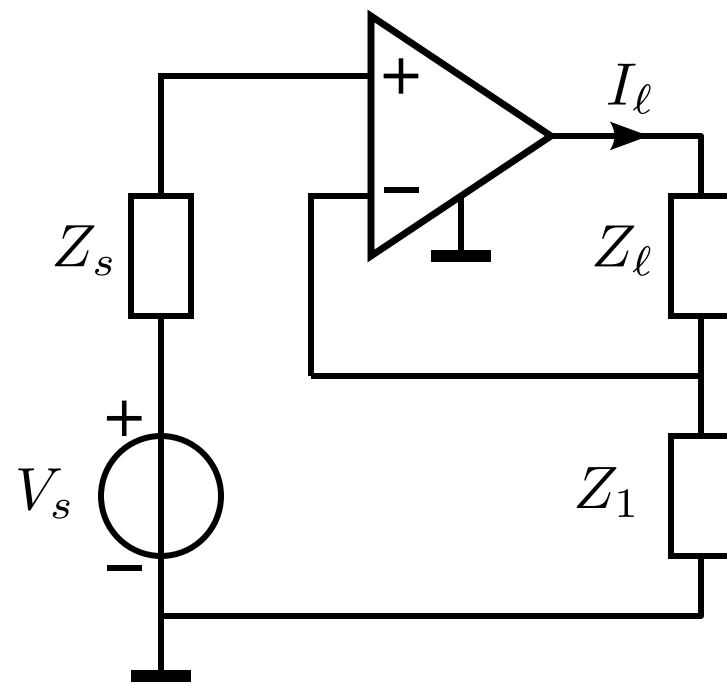


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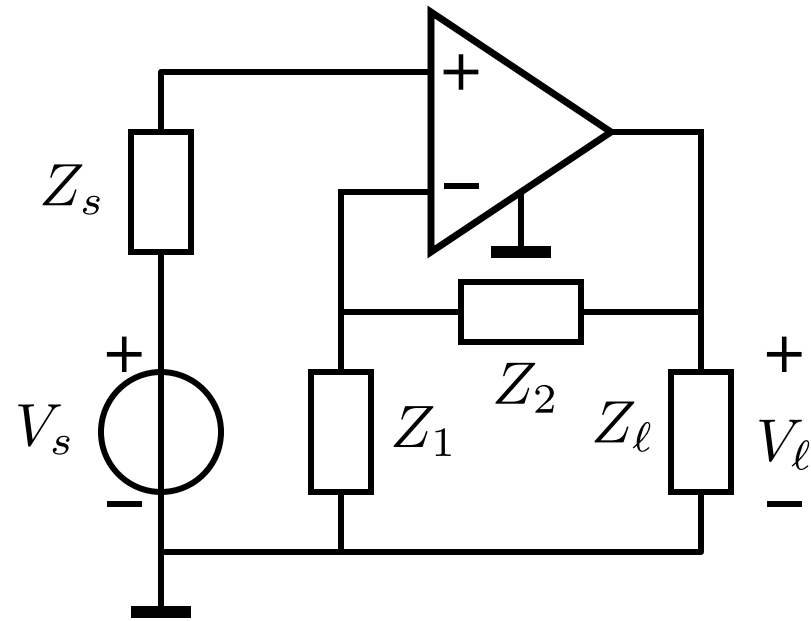
Non-inverting  
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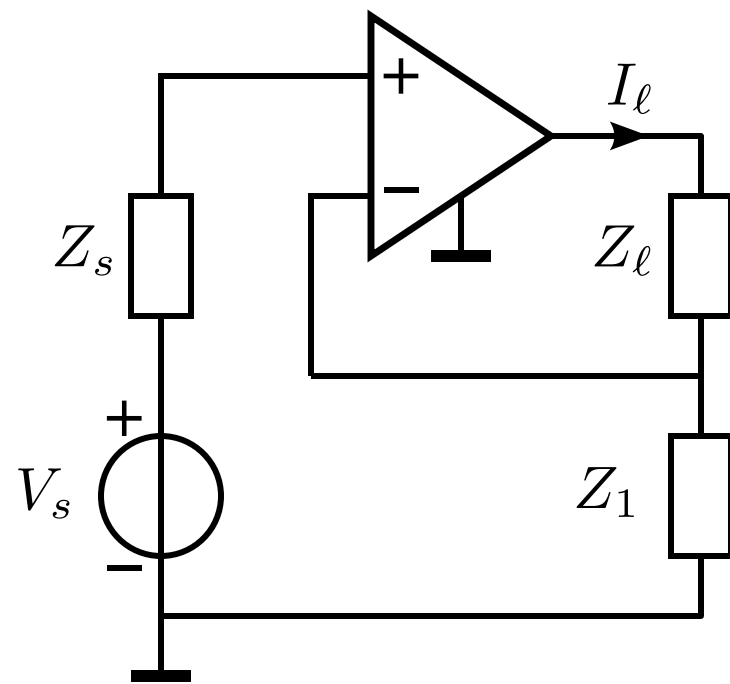
Transadmittance

# Single-loop passive feedback configurations



## Non-inverting voltage amplifier

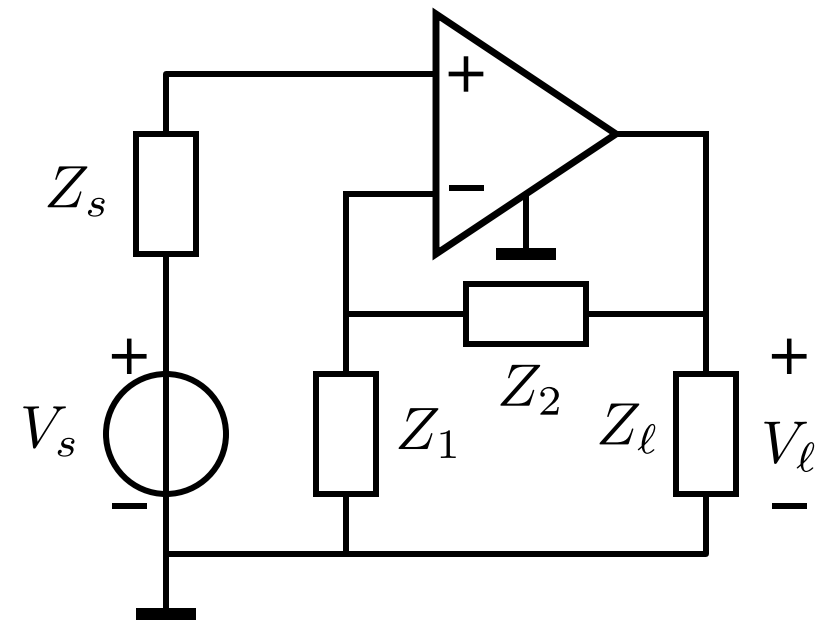
- Grounded source
- Grounded load



## Transadmittance

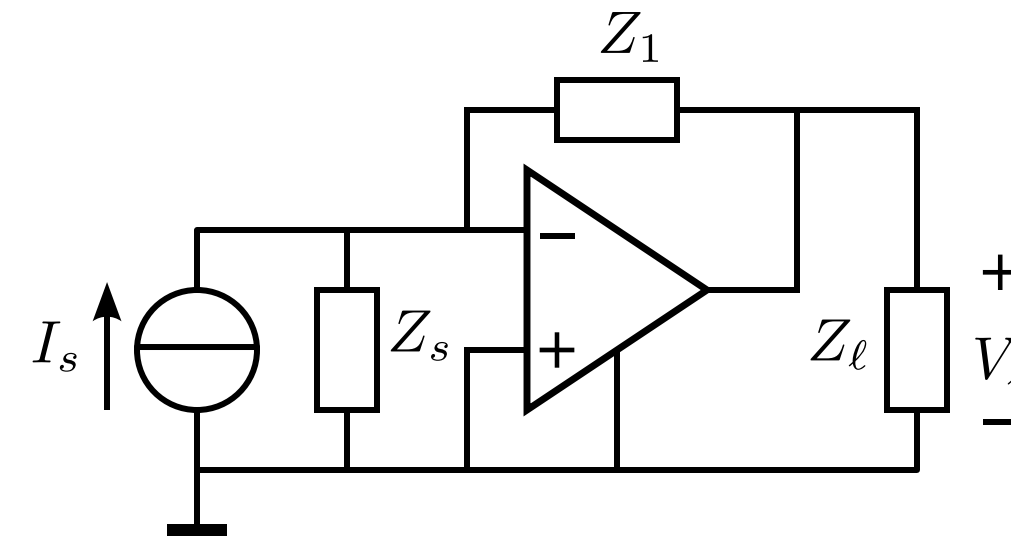
- Grounded source
- Floating load

# Single-loop passive feedback configurations

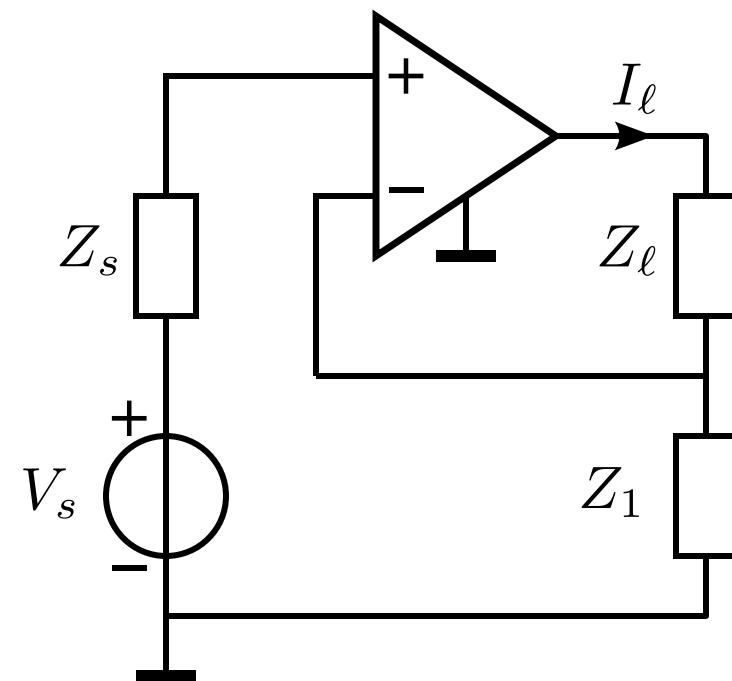


Non-inverting  
voltage amplifier

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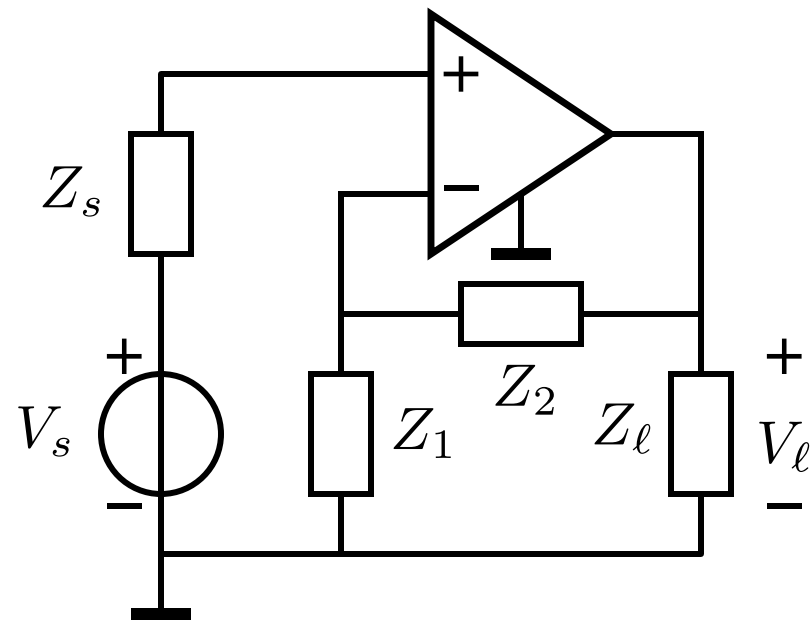
Inverting  
transimpedance



Transadmittance

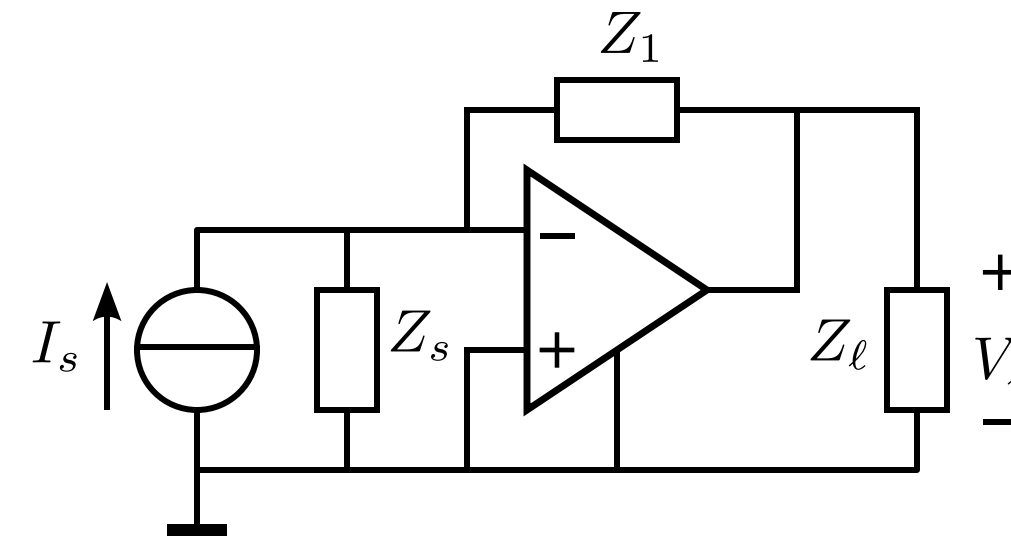
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# Single-loop passive feedback configurations



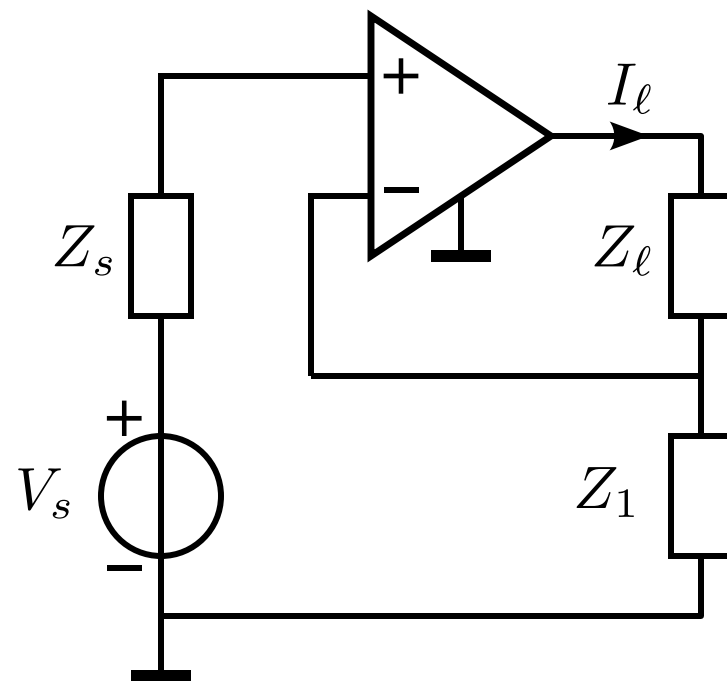
Non-inverting  
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Inverting  
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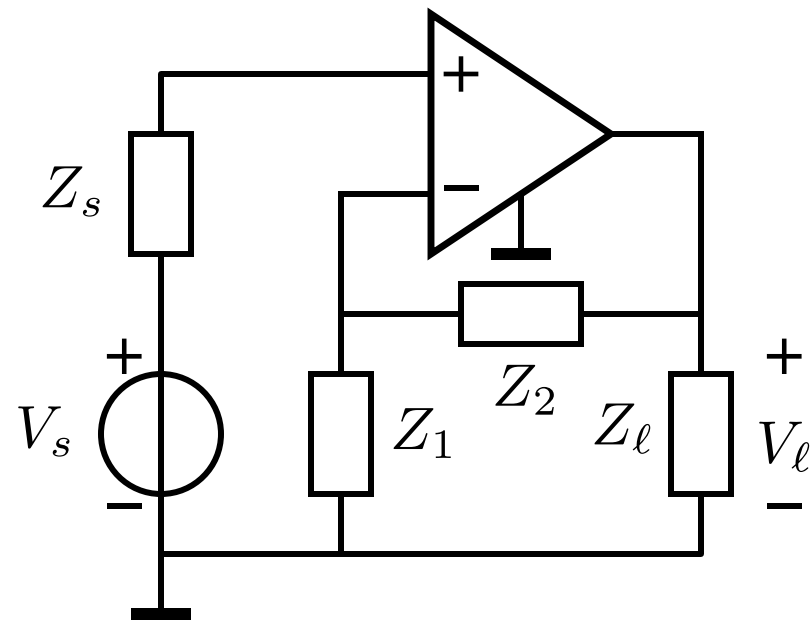
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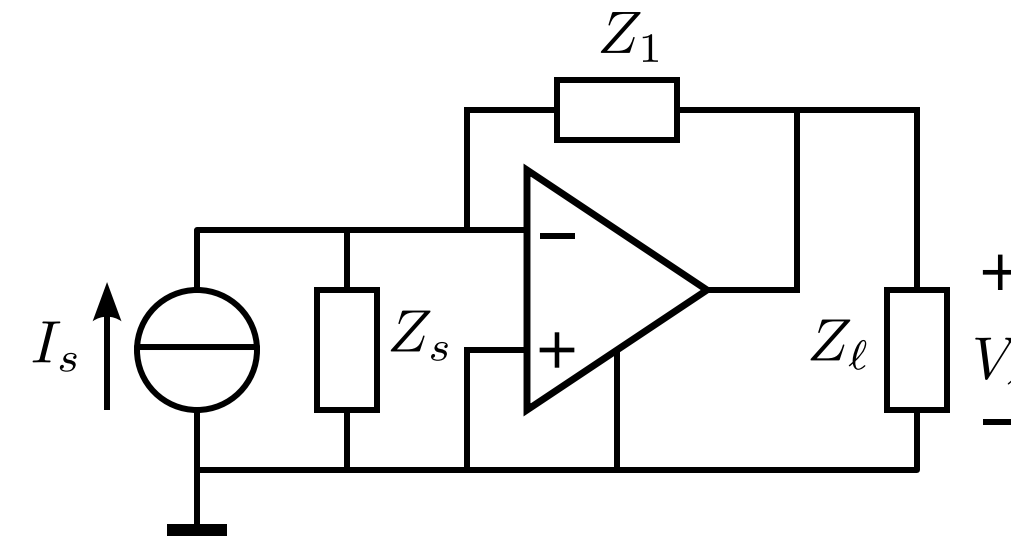
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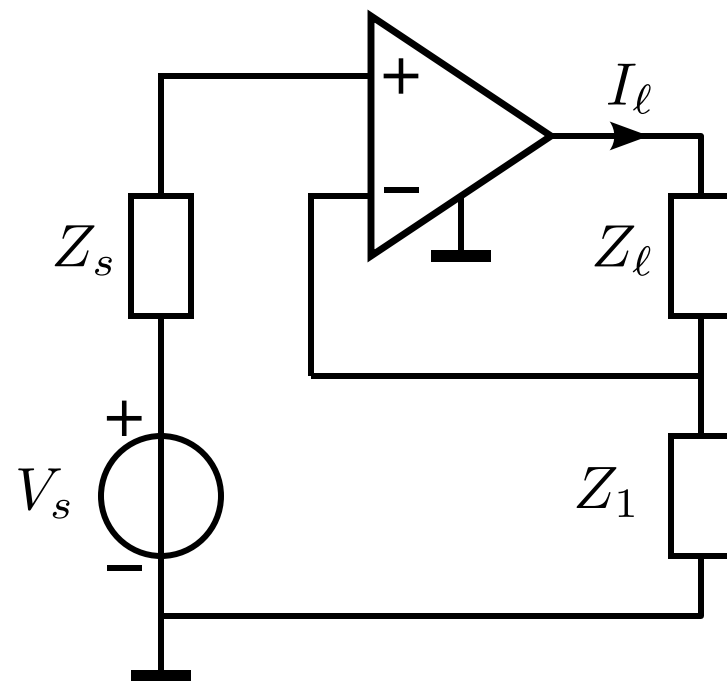
Non-inverting  
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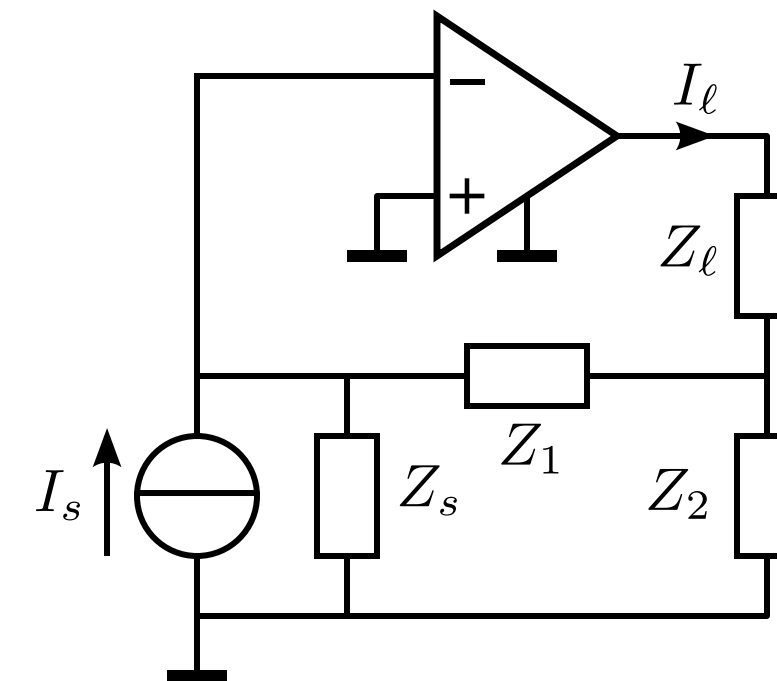
Inverting  
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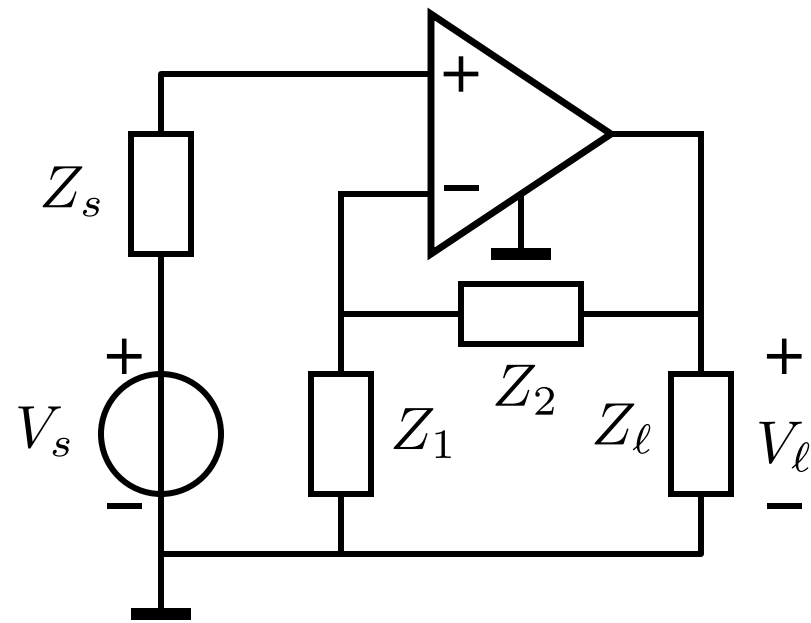
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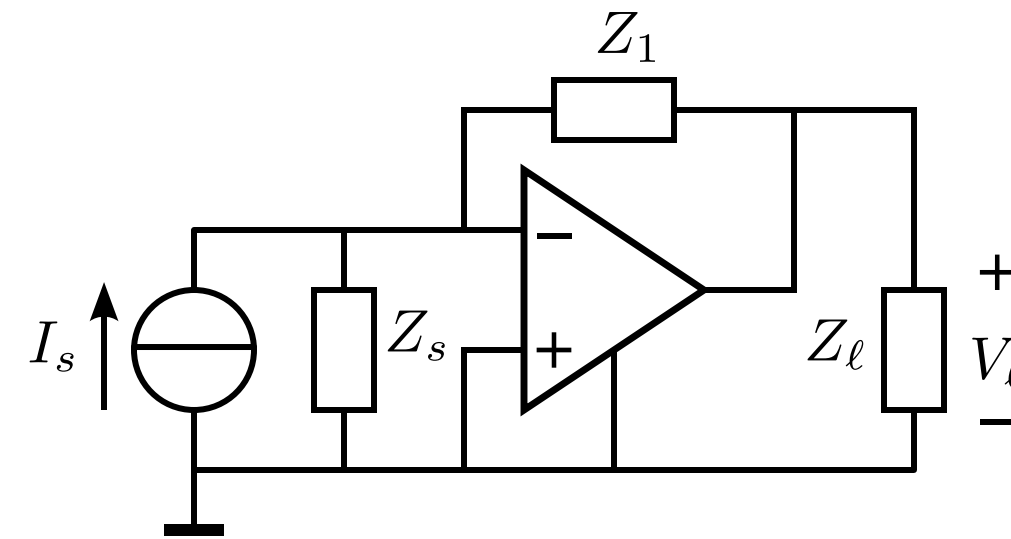
Current amplifier

# Single-loop passive feedback configurations



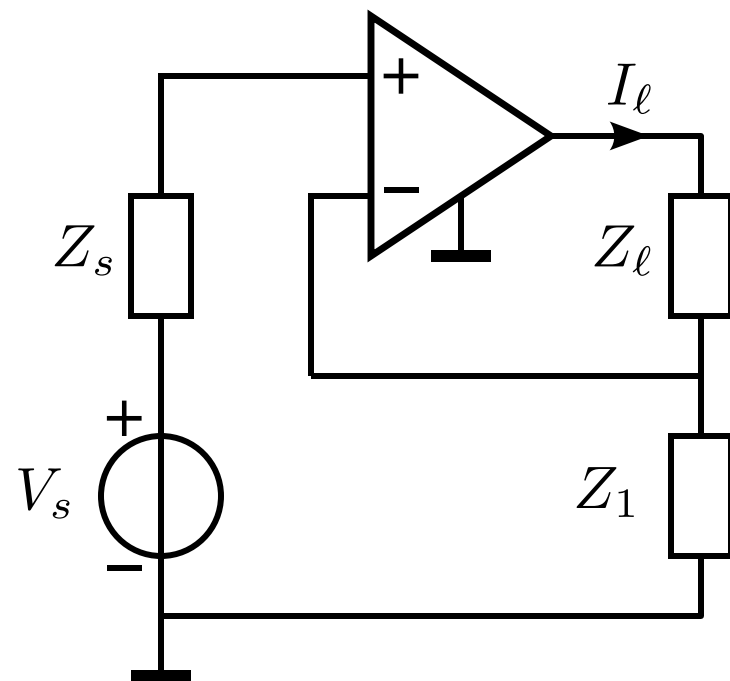
Non-inverting voltage amplifier

- Grounded source
- Grounded load



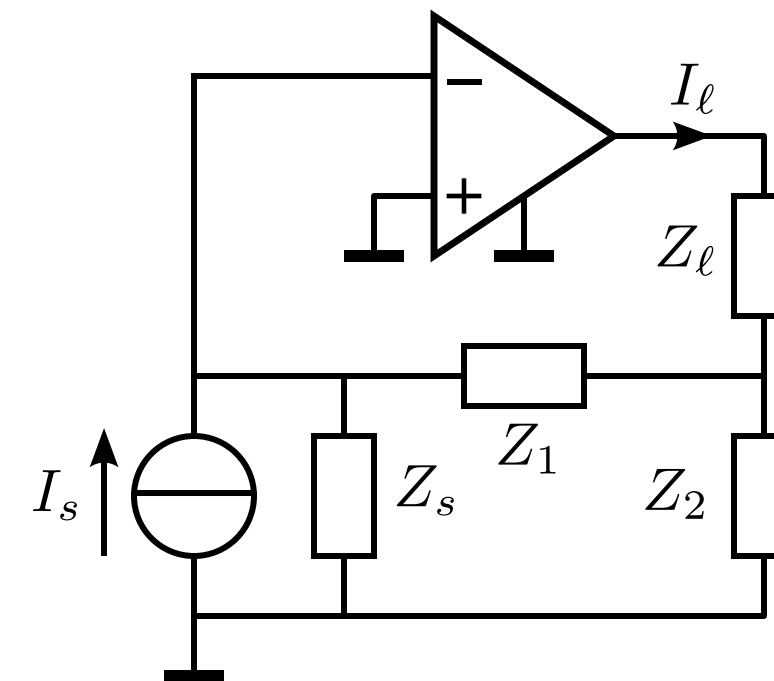
Inverting transimpedance

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- Grounded load



Transadmittance

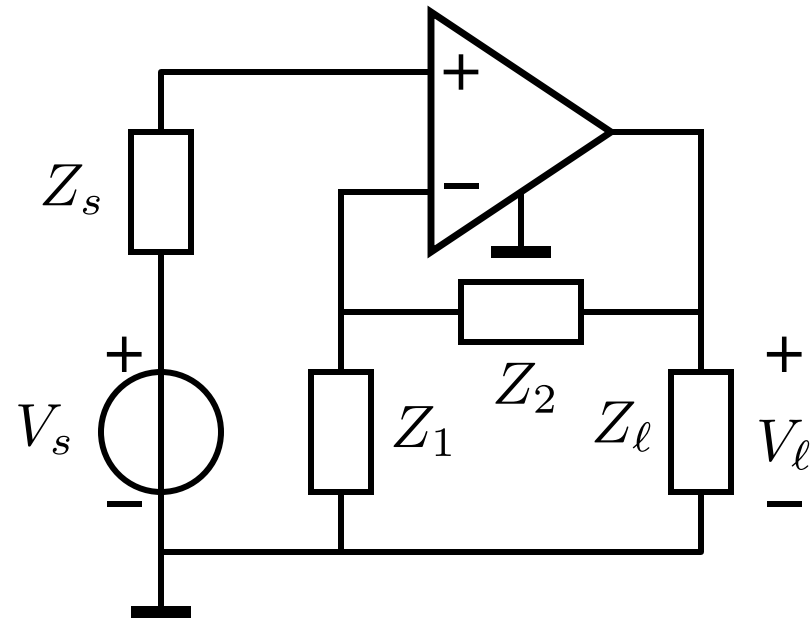
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Current amplifier

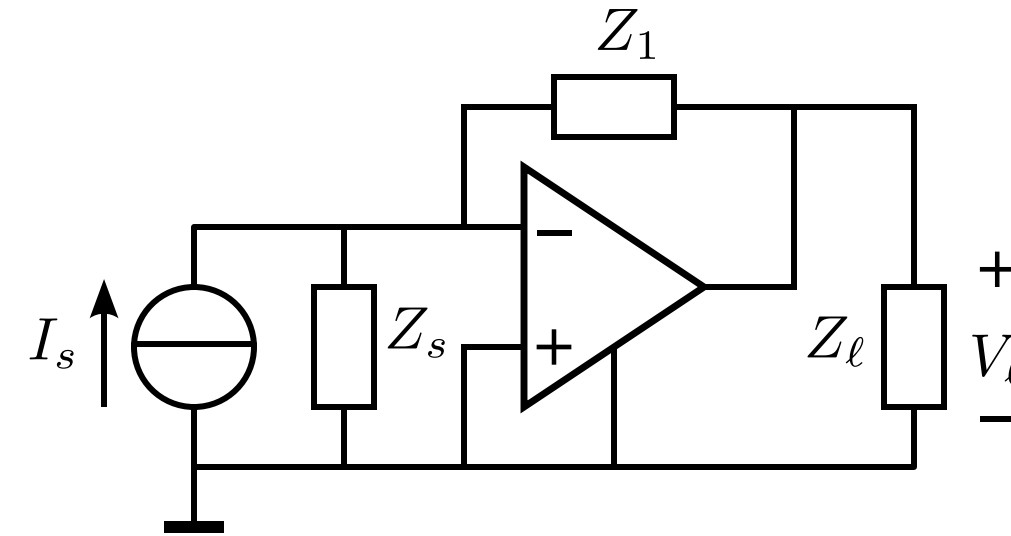
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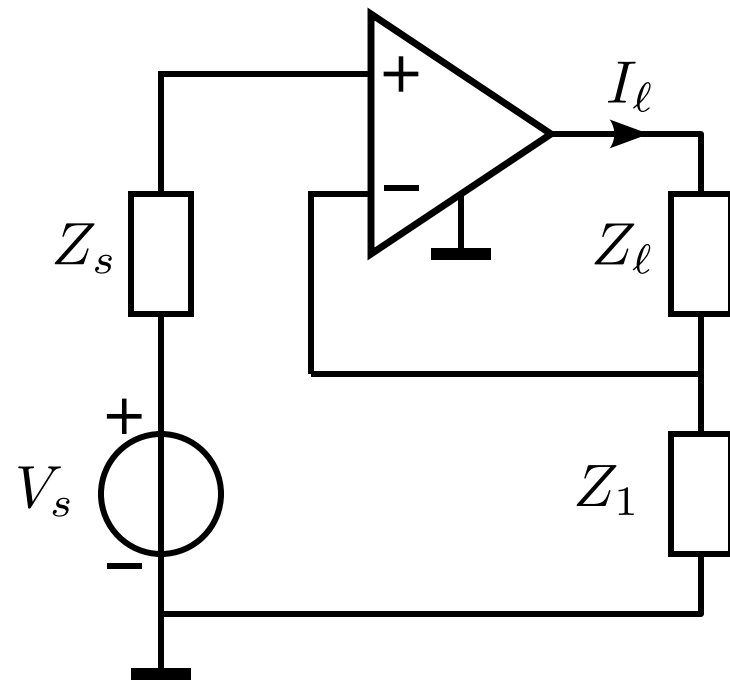
Non-inverting voltage amplifier

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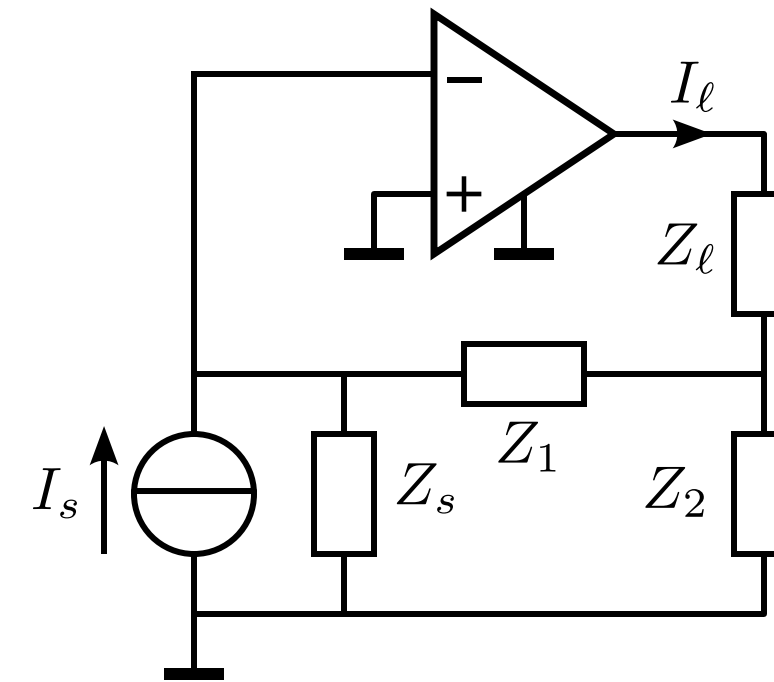
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Transadmittance

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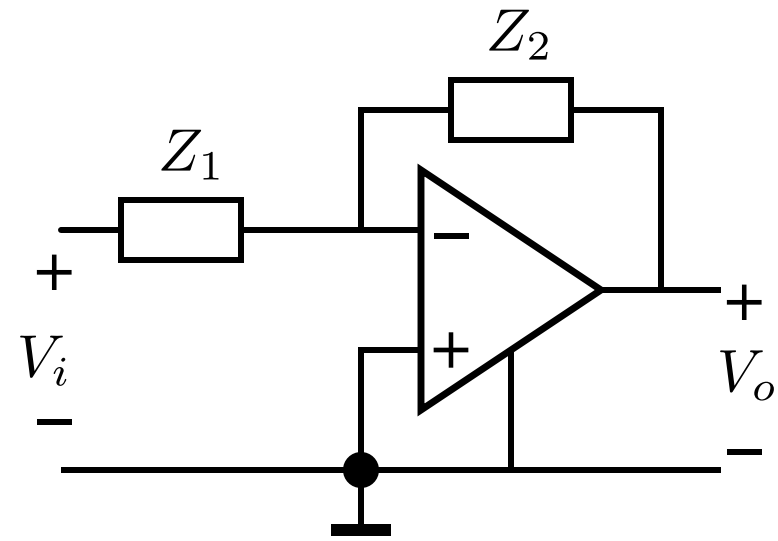
Current amplifier

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# Active feedback

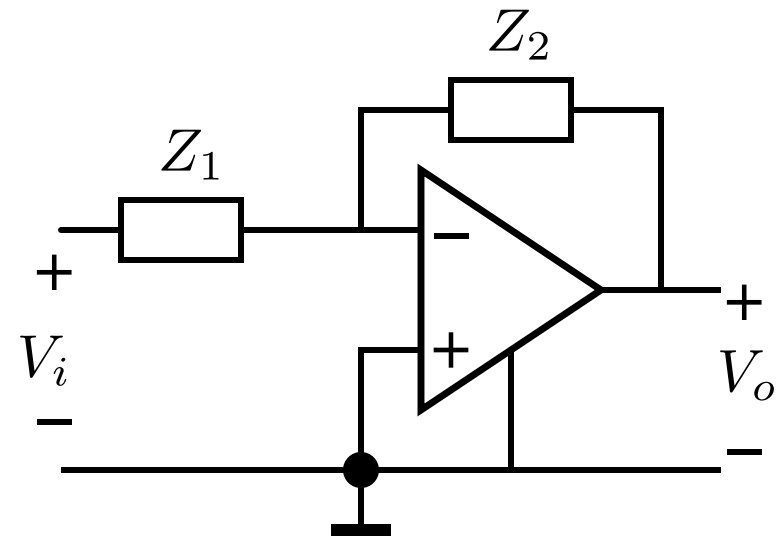


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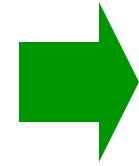


Active inverting  
voltage attenuator

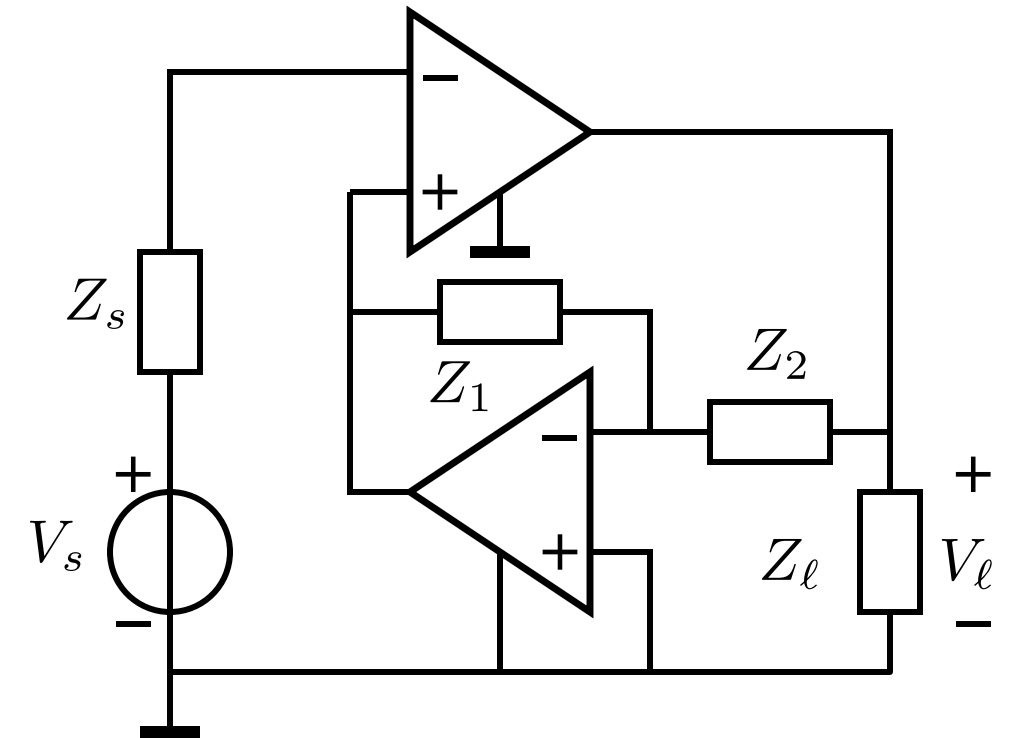
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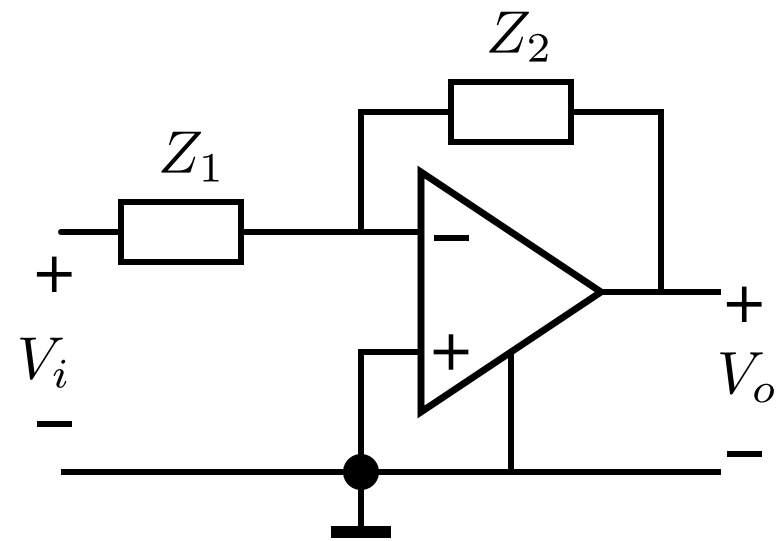
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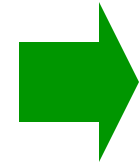
Inverting  
voltage amplifier



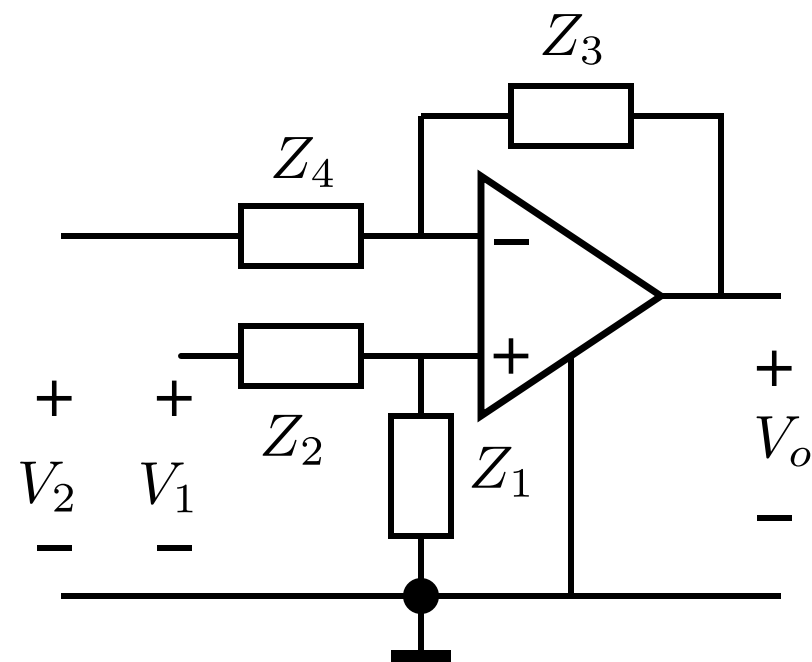
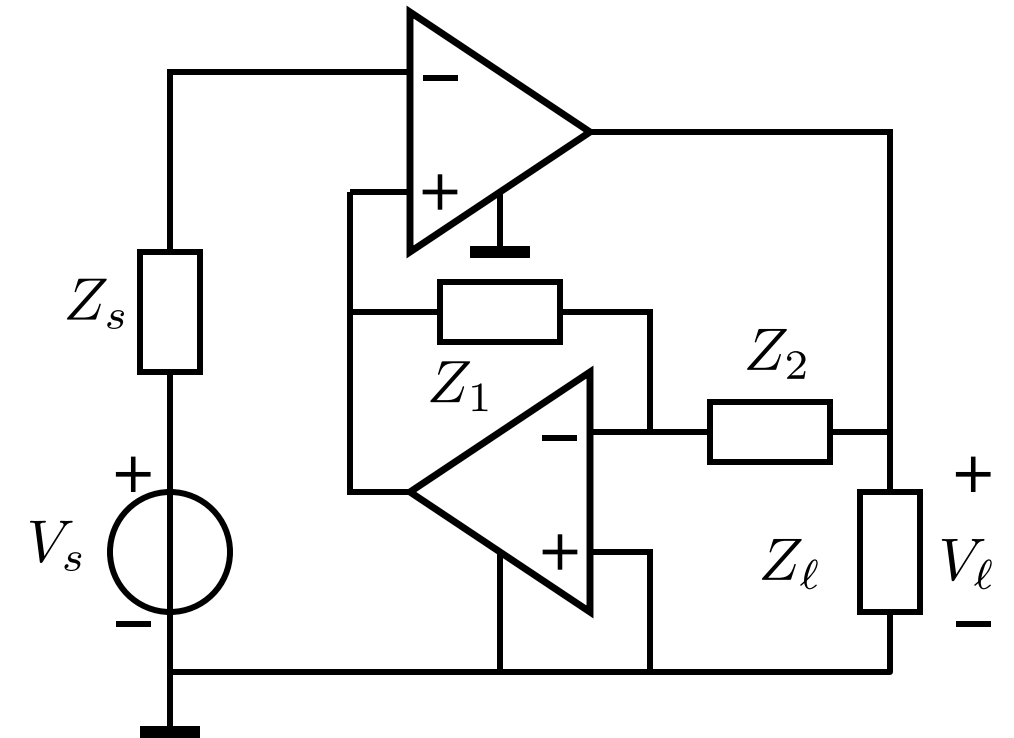
# Active feedback



Active inverting  
voltage attenuator



Inverting  
voltage amplifier

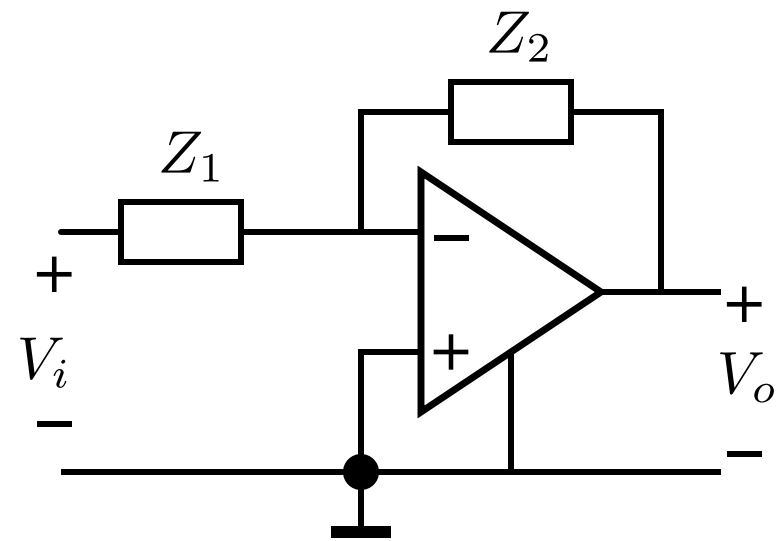


Floating voltage to  
grounded voltage

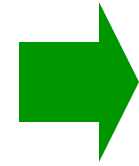
$$\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$$

$$V_o = \frac{Z_1}{Z_2} (V_1 - V_2)$$

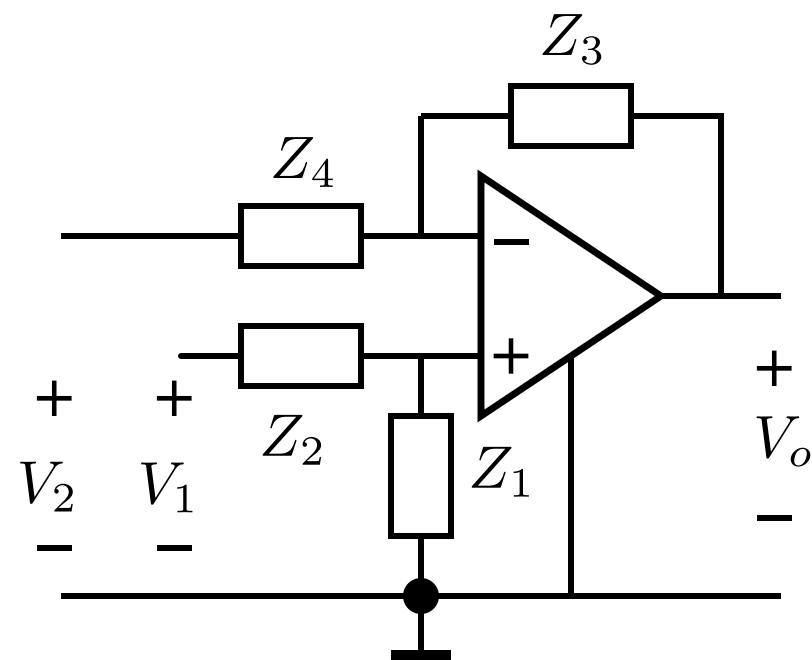
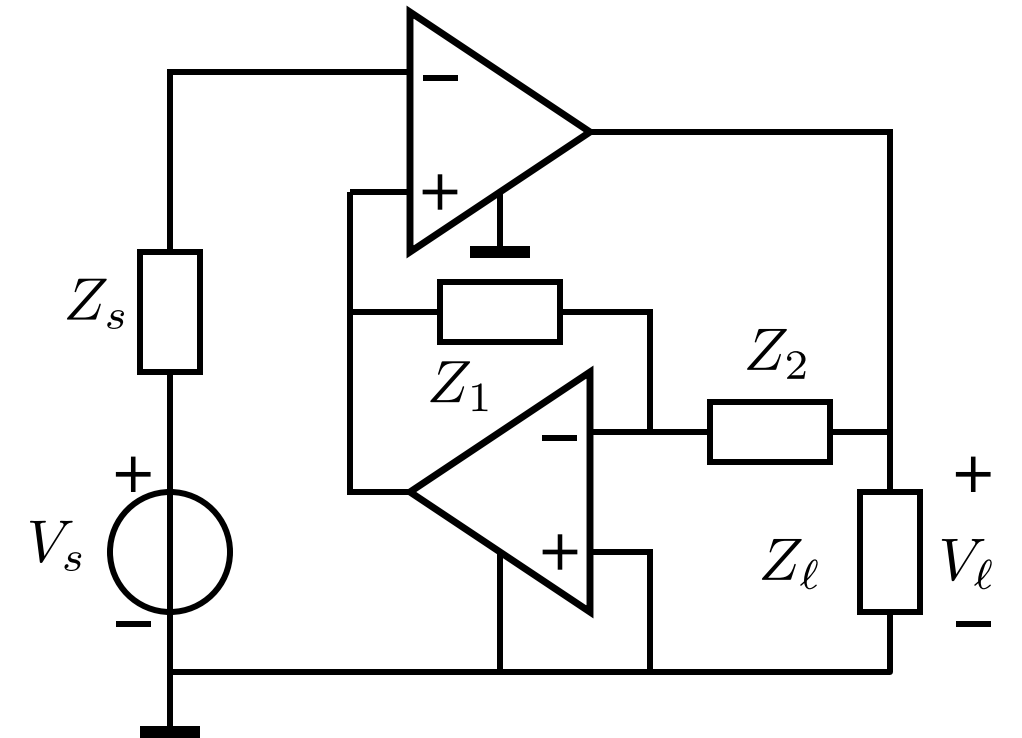
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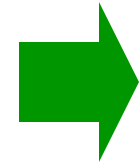
Active inverting  
voltage attenuator



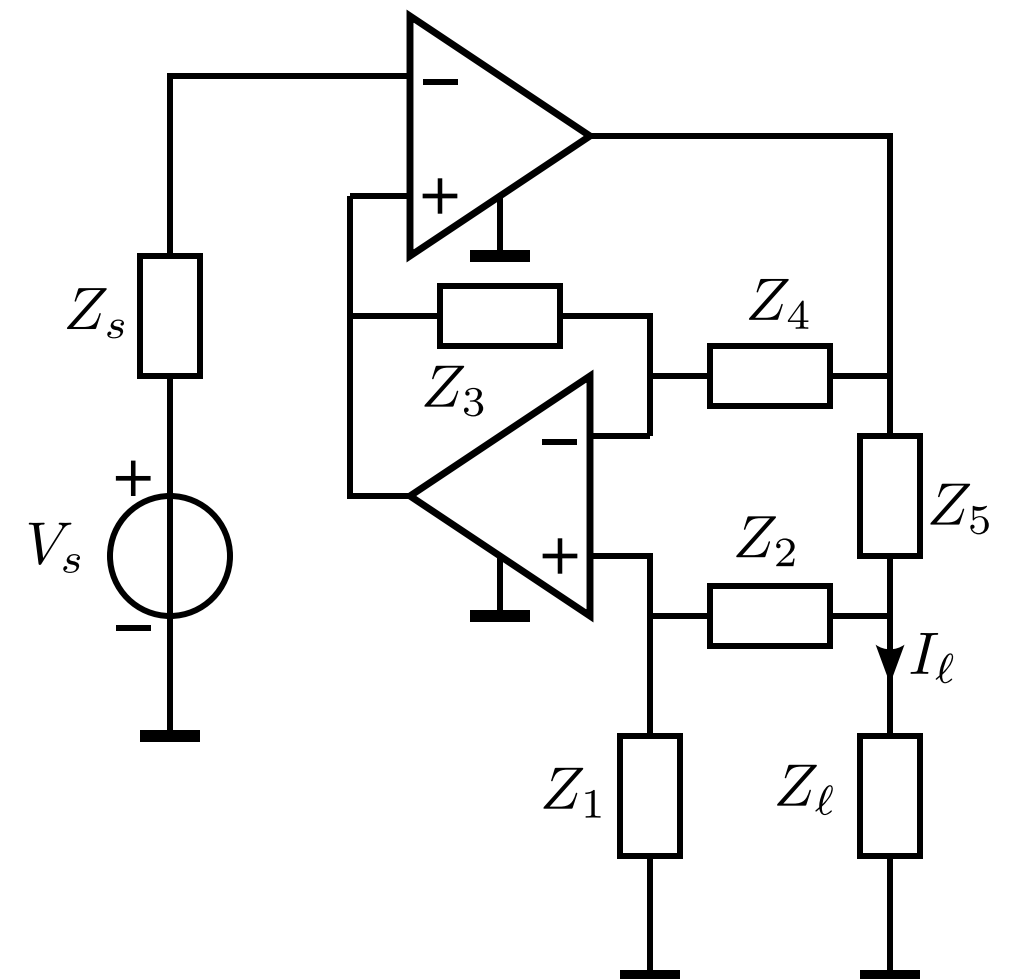
Inverting  
voltage amplifier



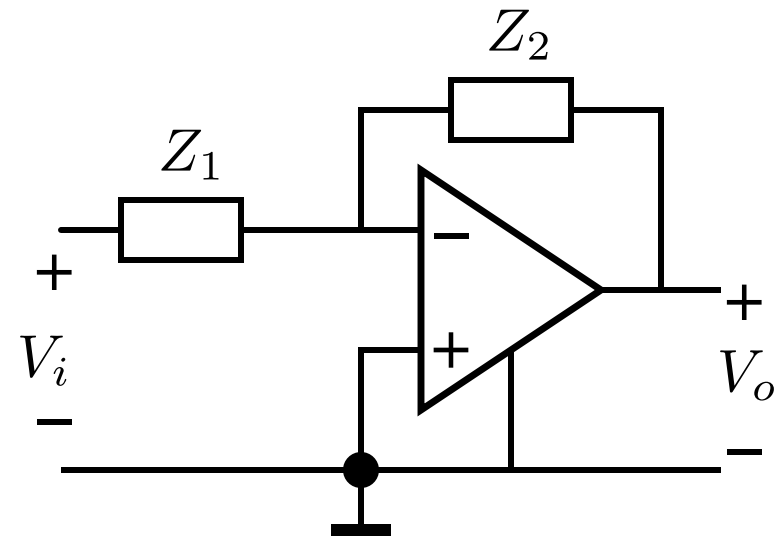
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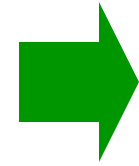
Transadmittance  
with grounded  
load



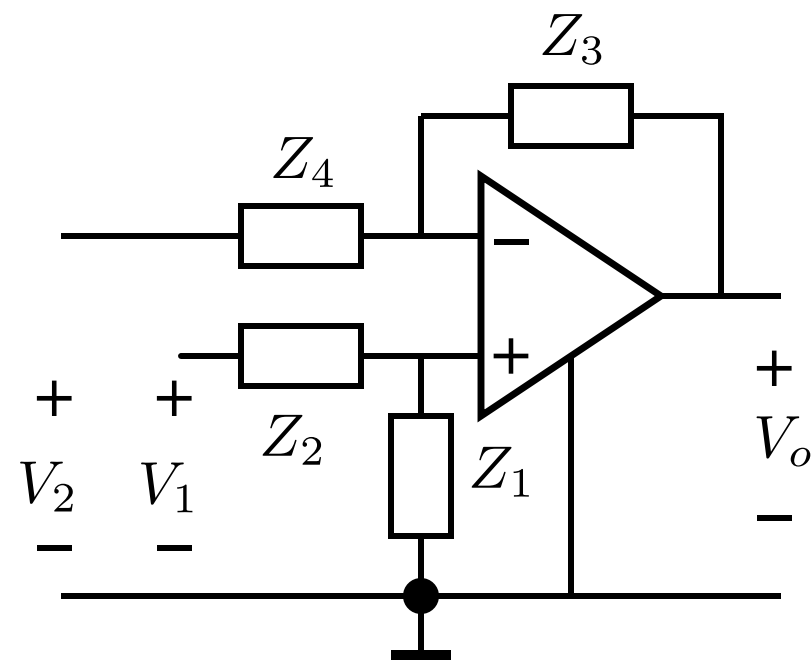
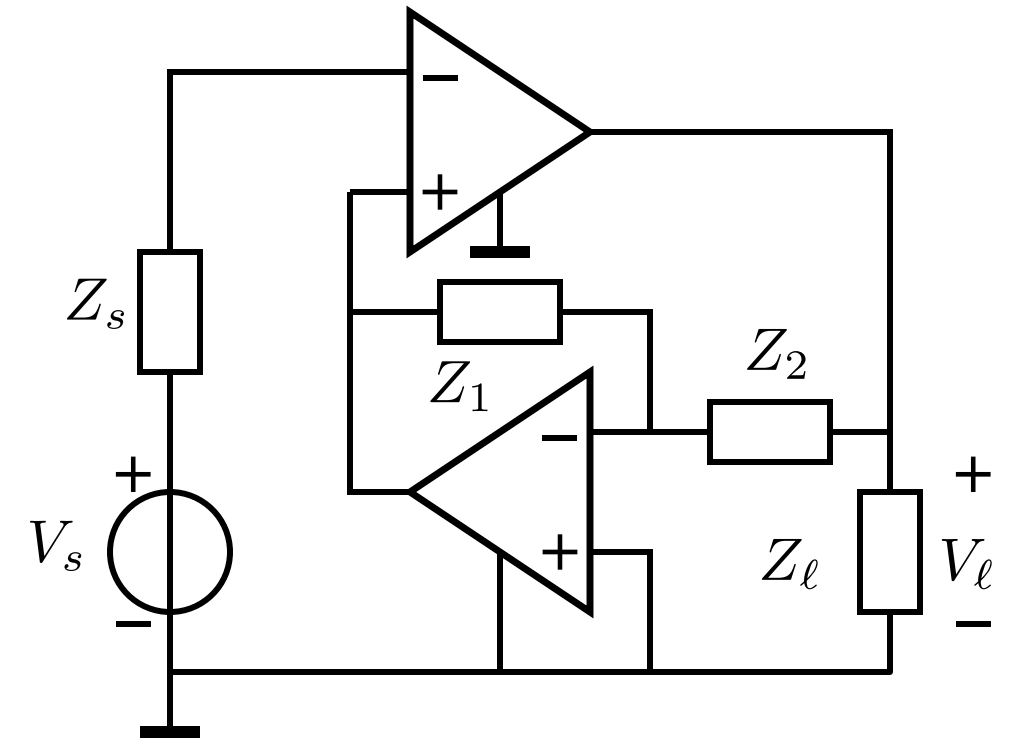
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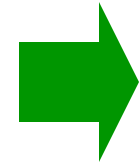
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Floating voltage to  
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Transadmittance  
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