

# **Structured Electronic Design**

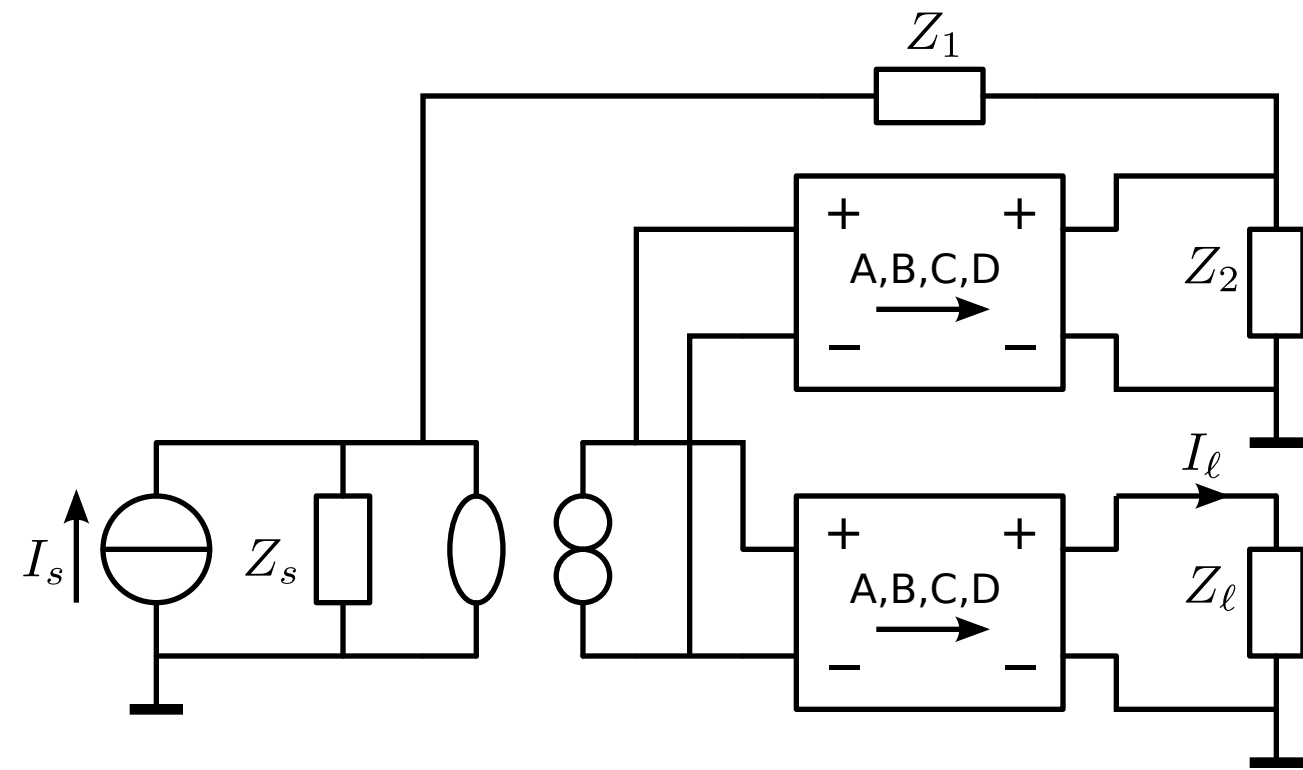
Other feedback stages

*Anton J.M. Montagne*

# Indirect feedback current amplifier

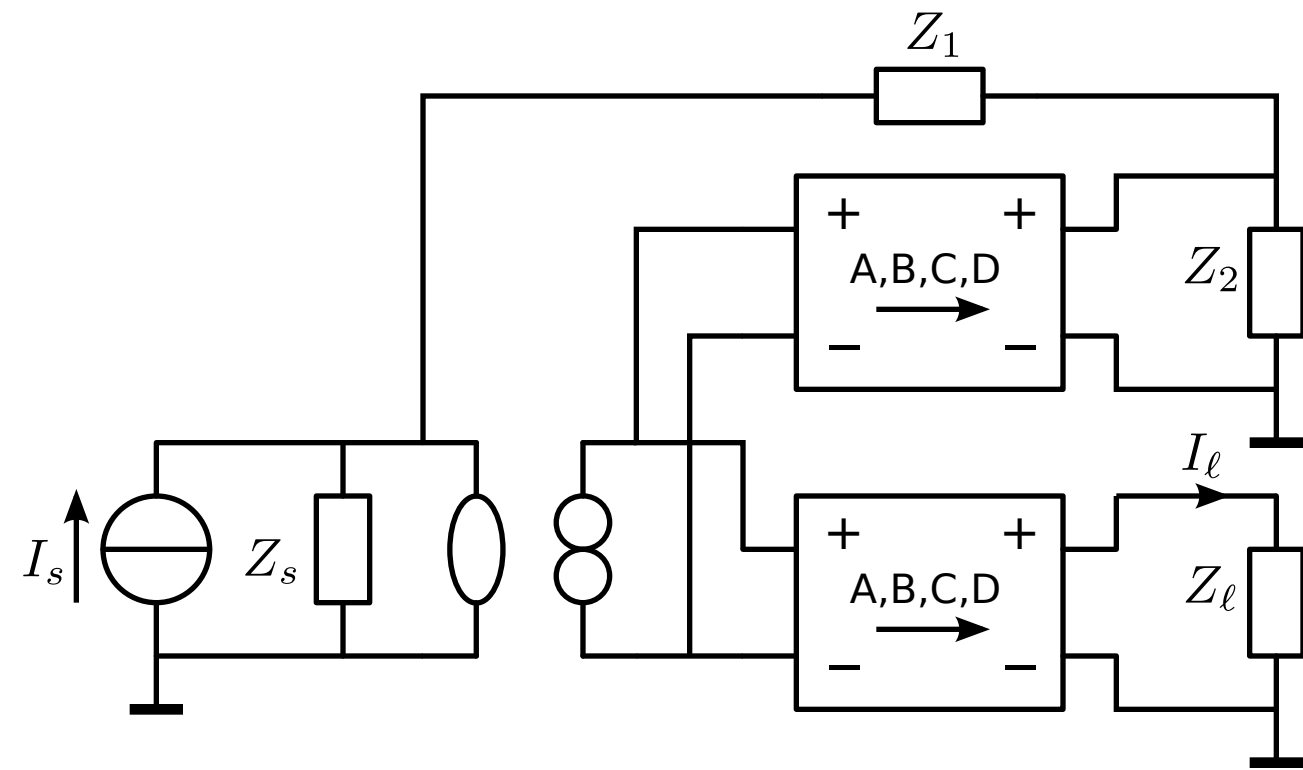
# Indirect feedback current amplifier

Inverting current amplifier  
indirect current sensing

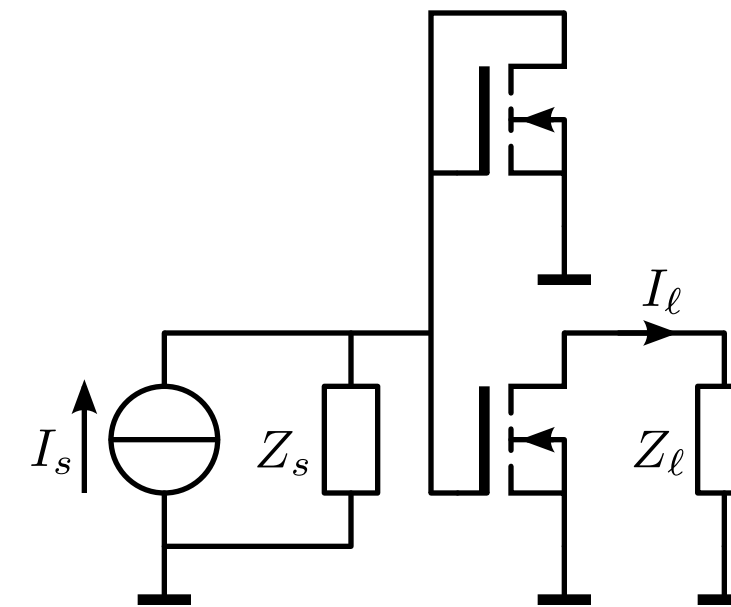


# Indirect feedback current amplifier

Inverting current amplifier  
indirect current sensing

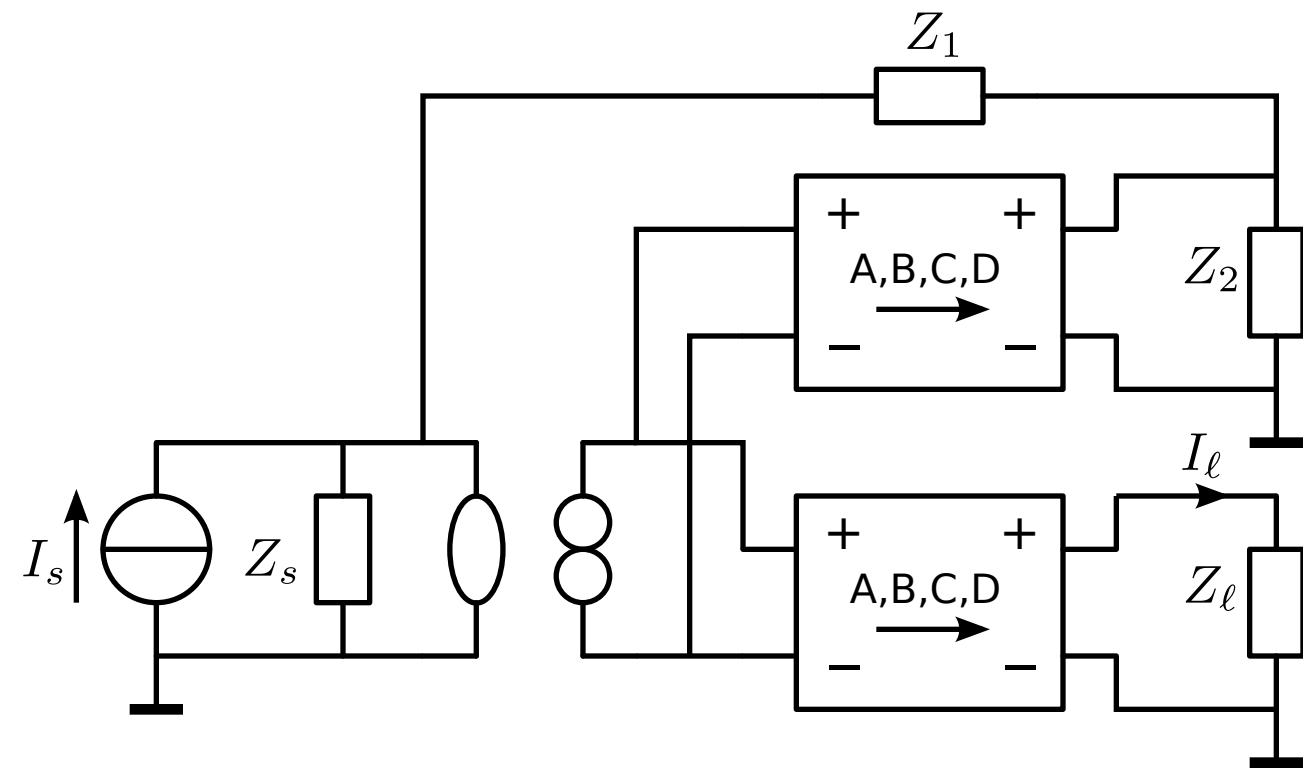


Unity-gain  
Single-transistor  
controller

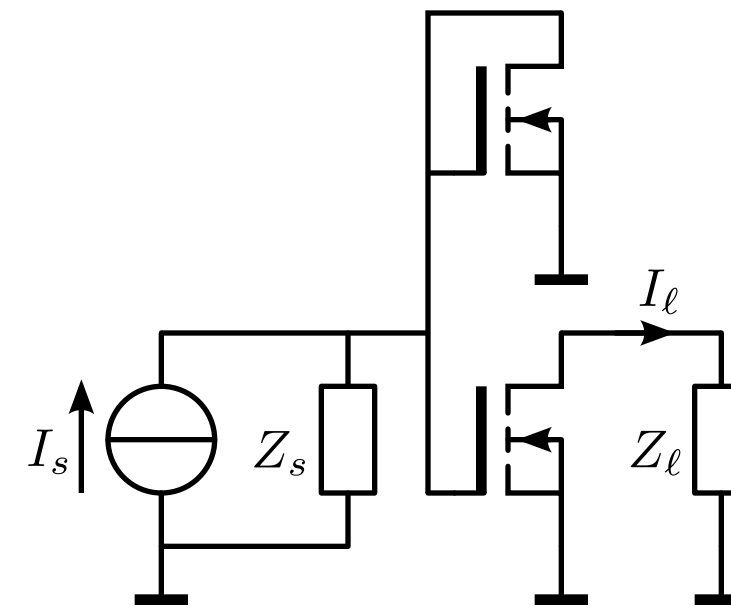


# Indirect feedback current amplifier

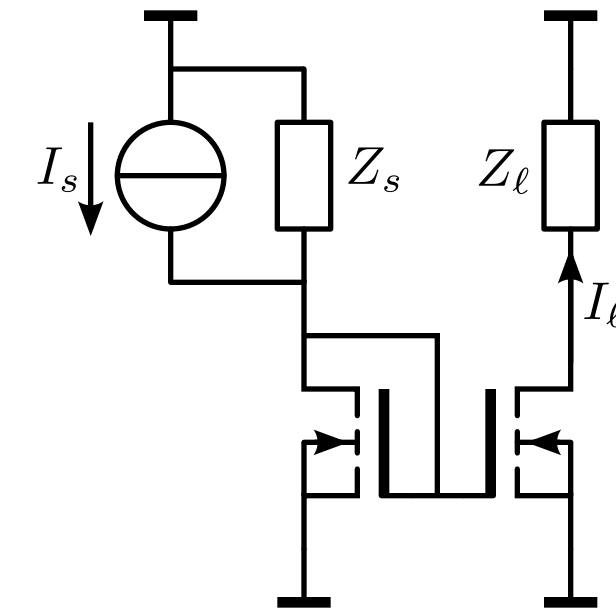
Inverting current amplifier  
indirect current sensing



Unity-gain  
Single-transistor  
controller

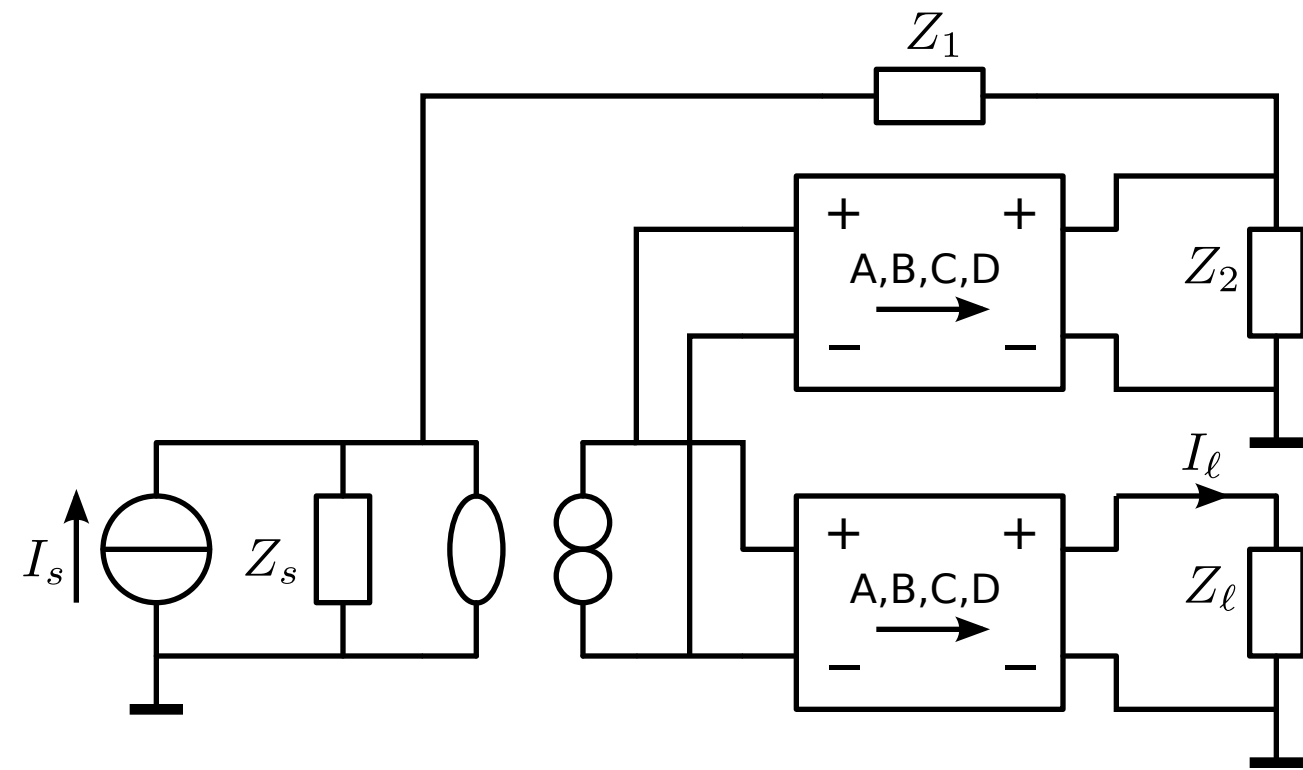


Current mirror

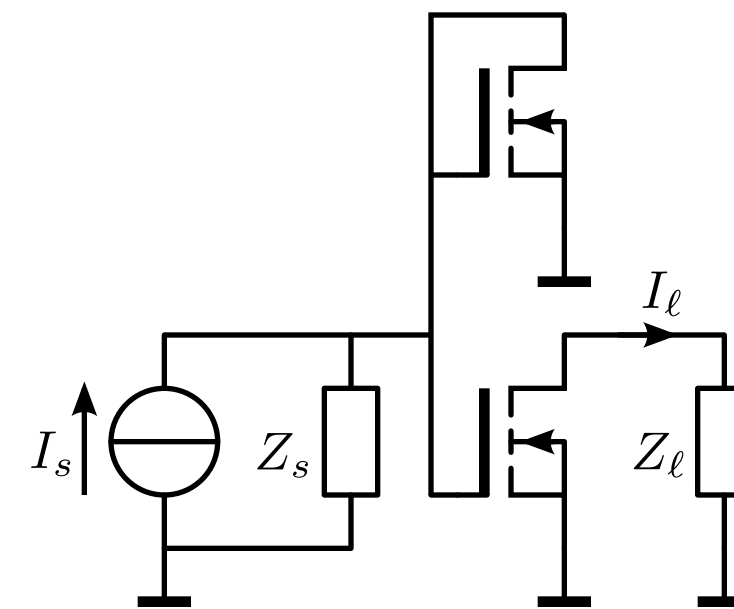


# Indirect feedback current amplifier

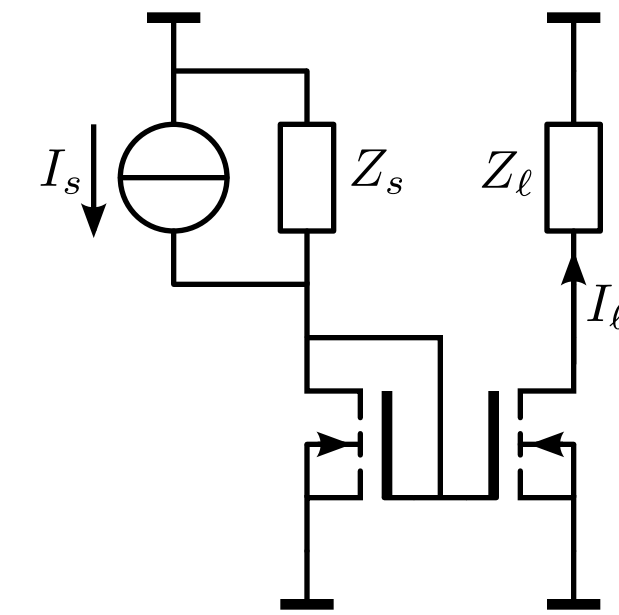
Inverting current amplifier  
indirect current sensing



Unity-gain  
Single-transistor  
controller



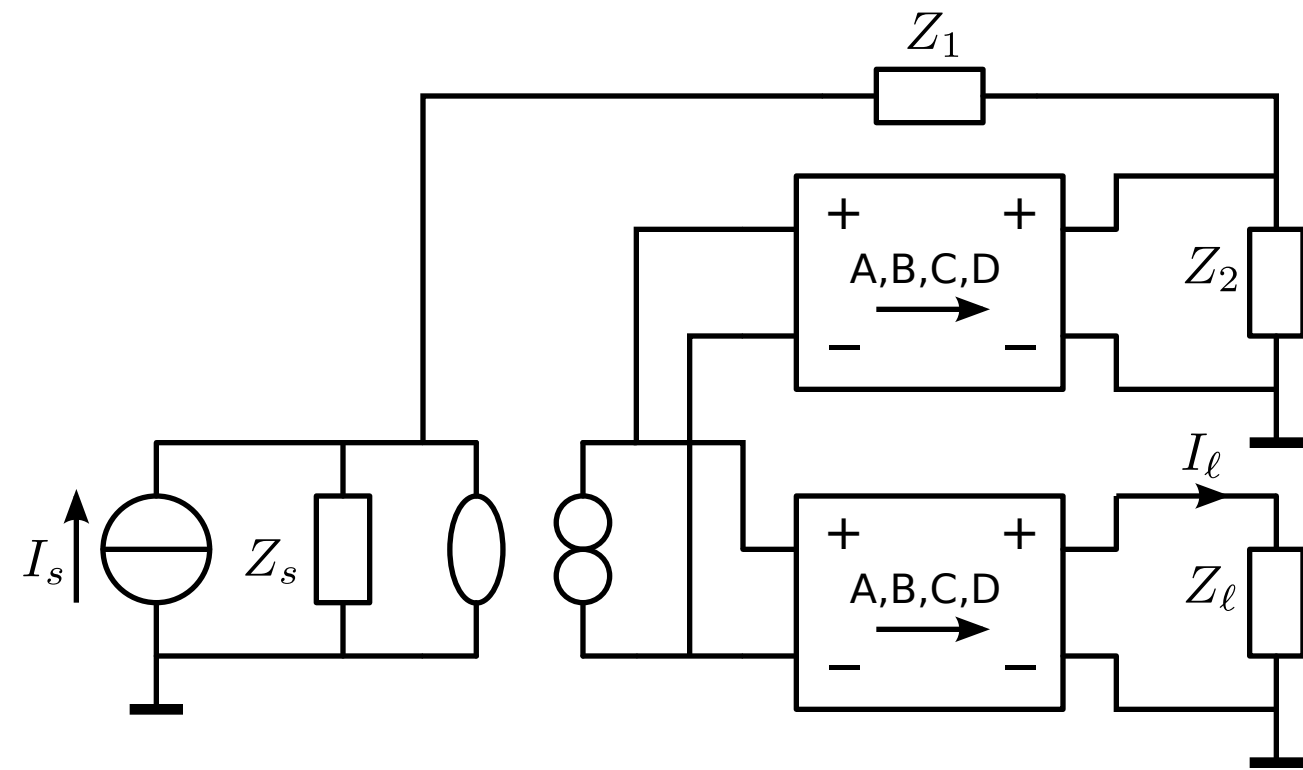
Current mirror



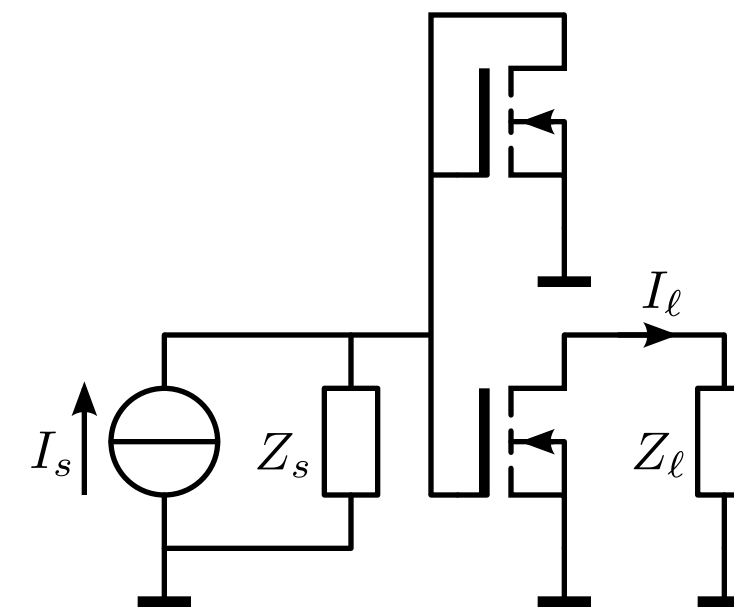
indirect current sensing:

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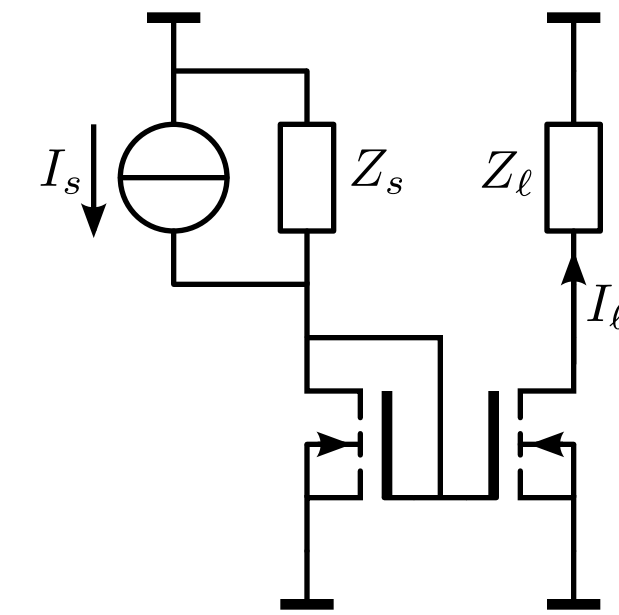
Inverting current amplifier  
indirect current sensing



Unity-gain  
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Current mirror

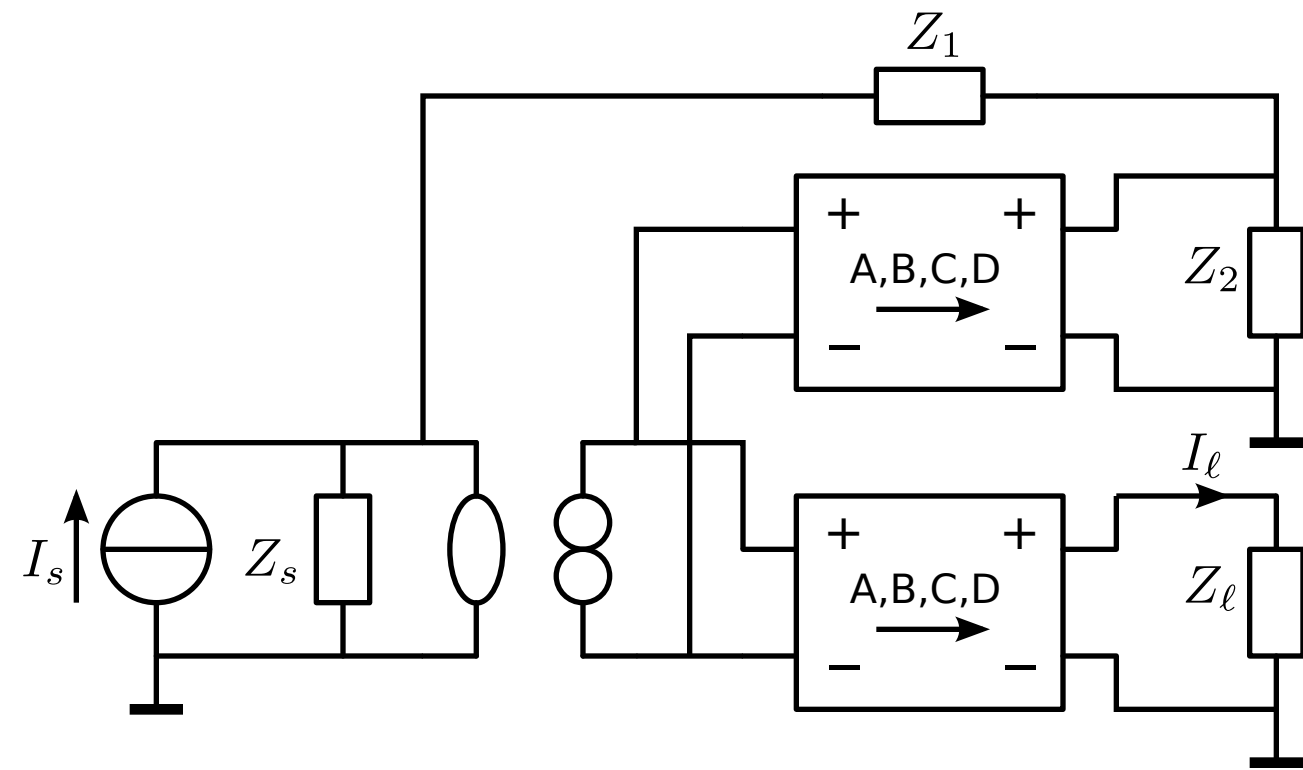


indirect current sensing:

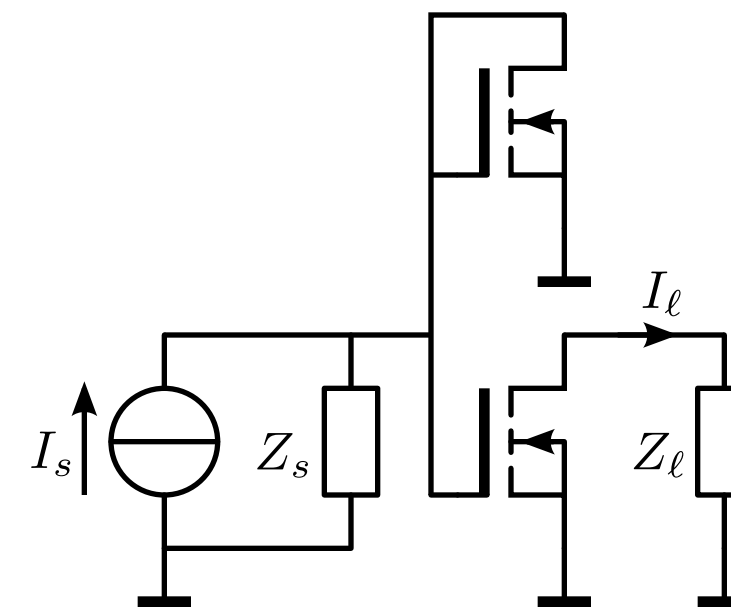
Feedback has no influence on the output impedance

# Indirect feedback current amplifier

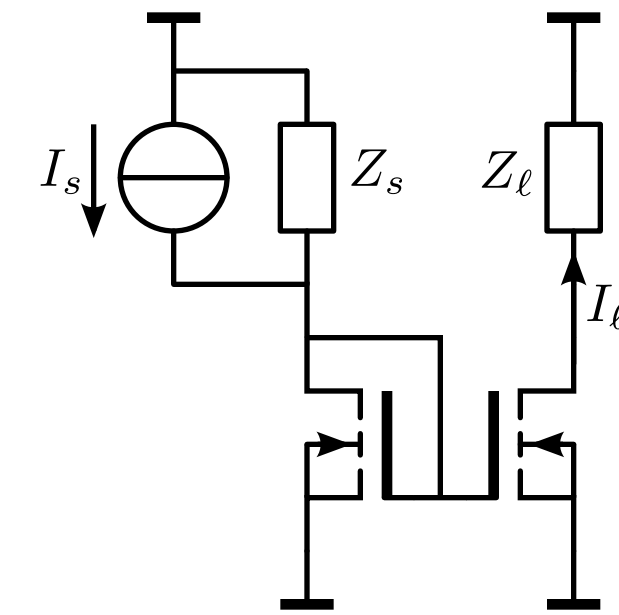
Inverting current amplifier  
indirect current sensing



Unity-gain  
Single-transistor  
controller



Current mirror



indirect current sensing:

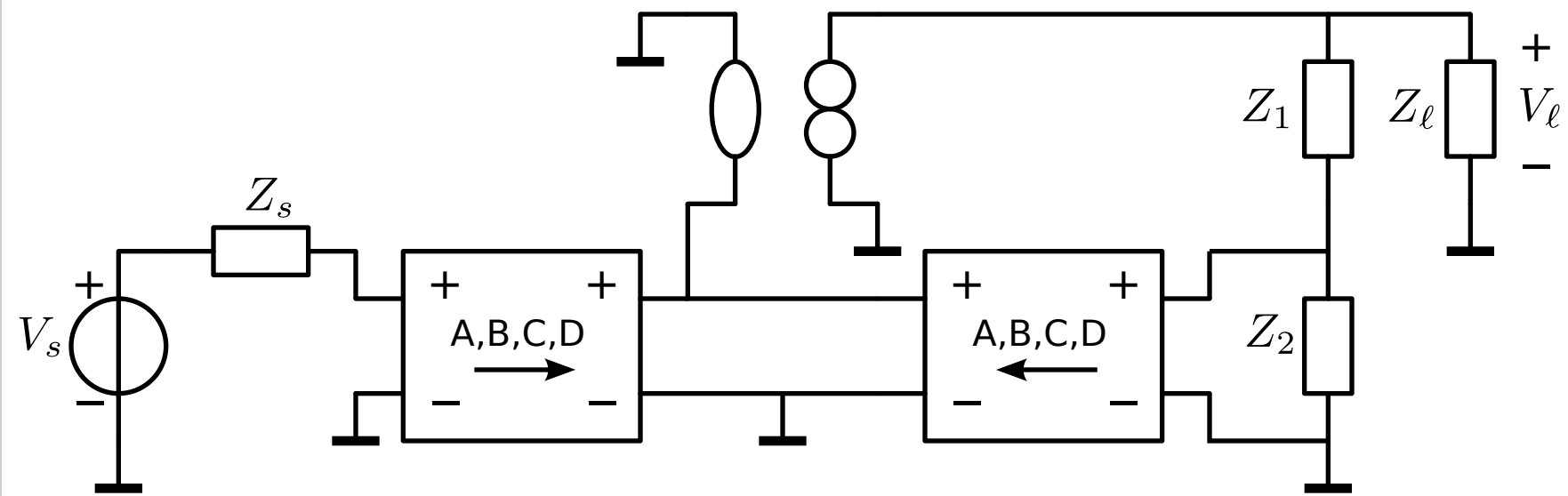
Feedback has no influence on the output impedance



# Indirect feedback voltage amplifier

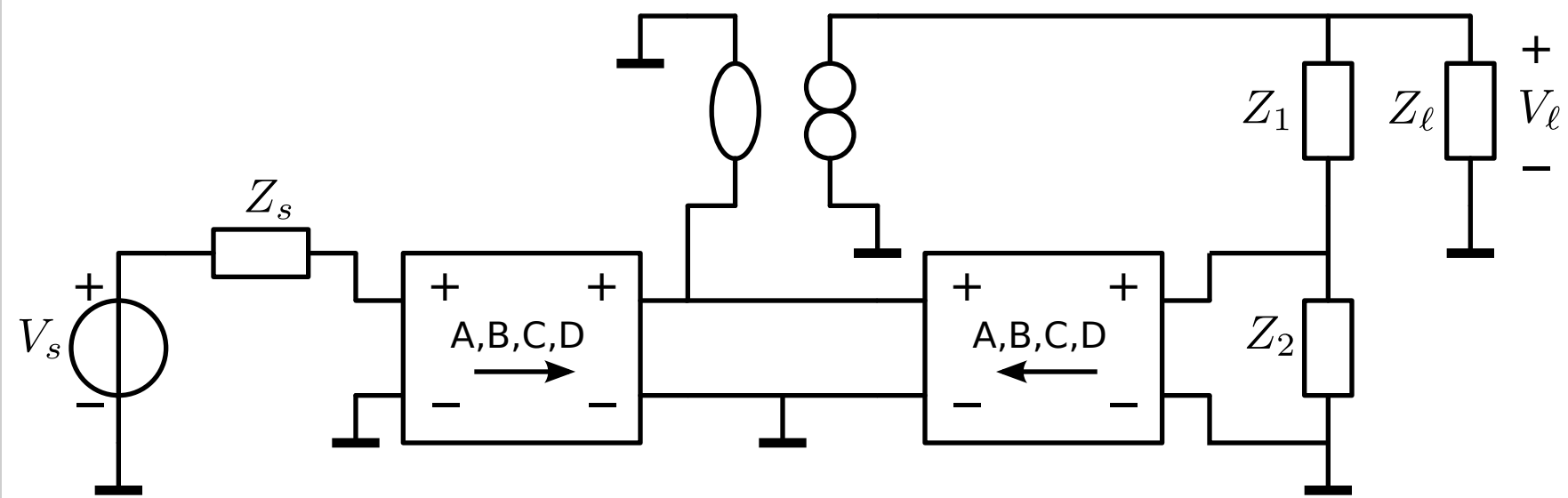
# Indirect feedback voltage amplifier

Inverting voltage amplifier  
indirect voltage comparison

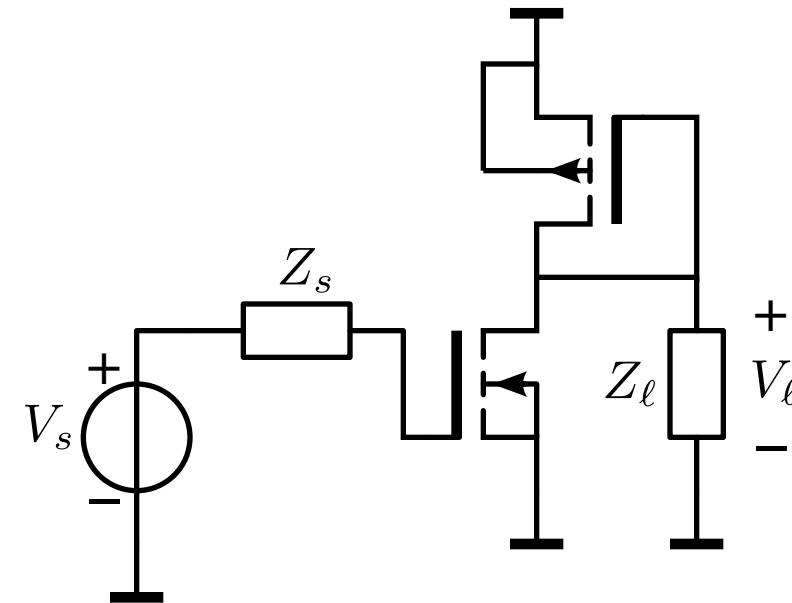


# Indirect feedback voltage amplifier

Inverting voltage amplifier  
indirect voltage comparison

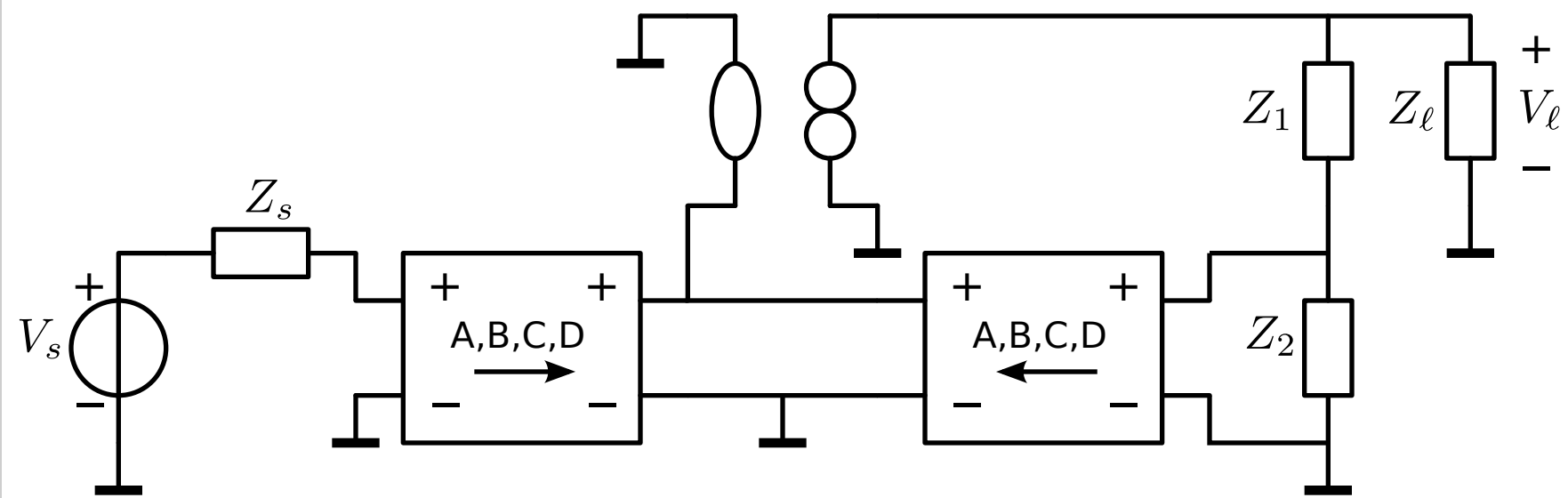


Unity-gain  
Single-transistor  
controller

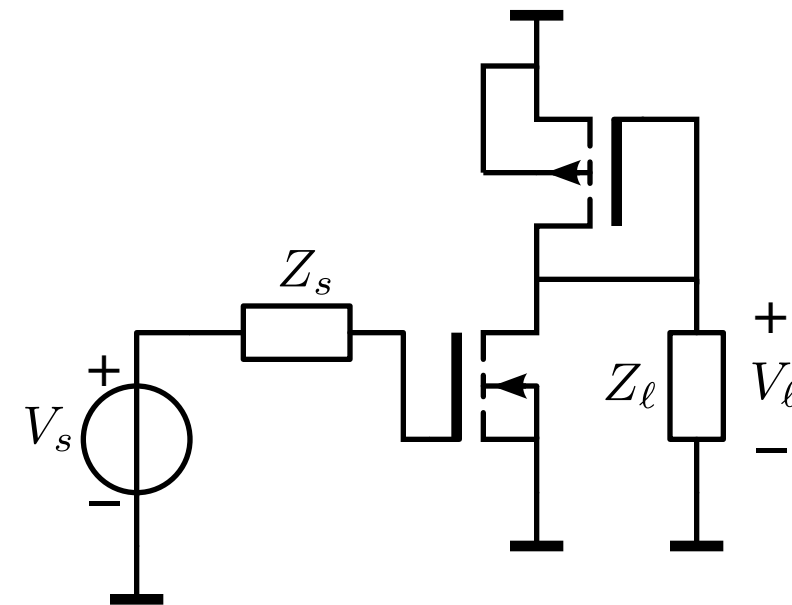


# Indirect feedback voltage amplifier

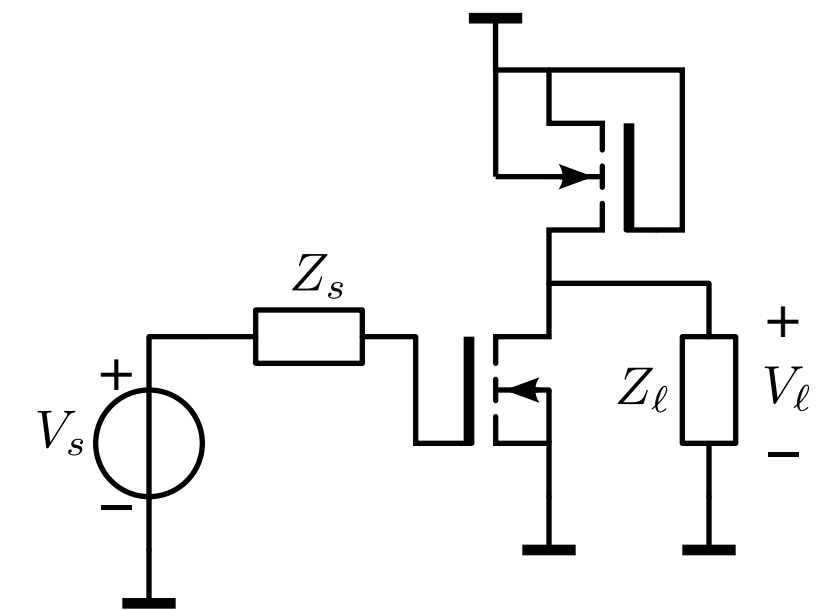
Inverting voltage amplifier  
indirect voltage comparison



Unity-gain  
Single-transistor  
controller

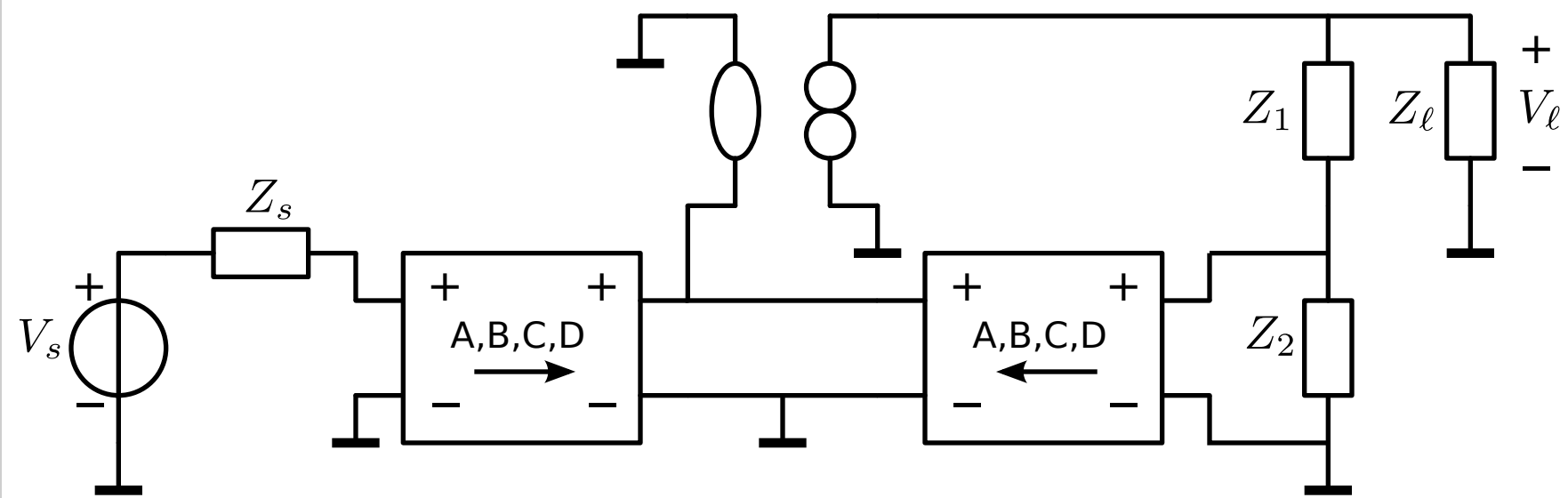


Voltage mirror

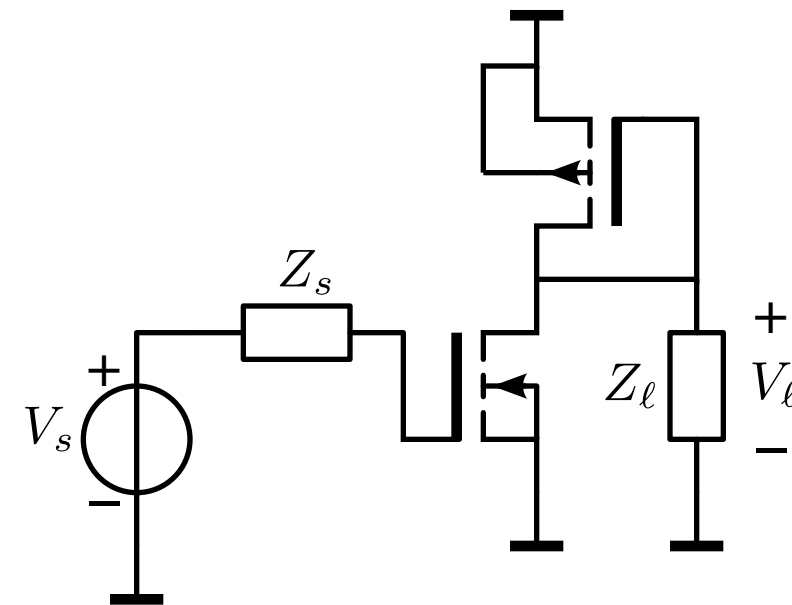


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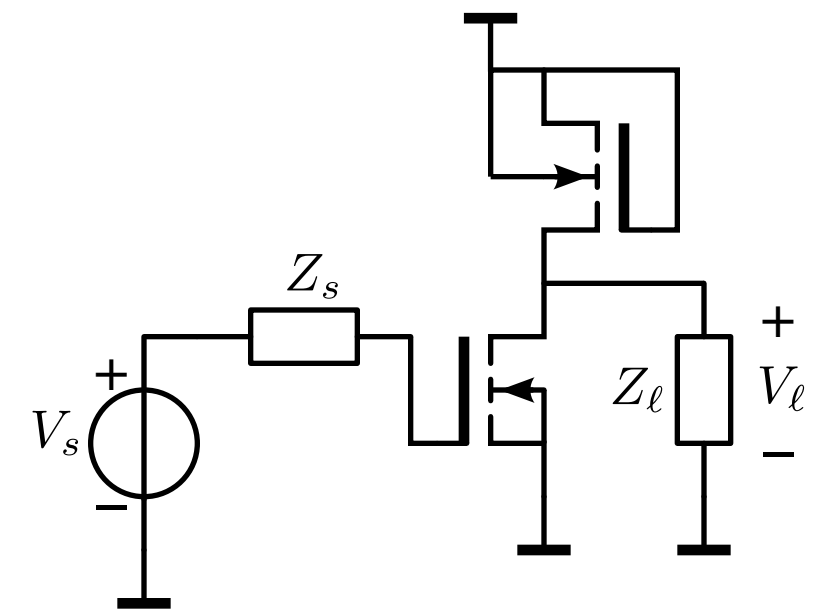
Inverting voltage amplifier  
indirect voltage comparison



Unity-gain  
Single-transistor  
controller



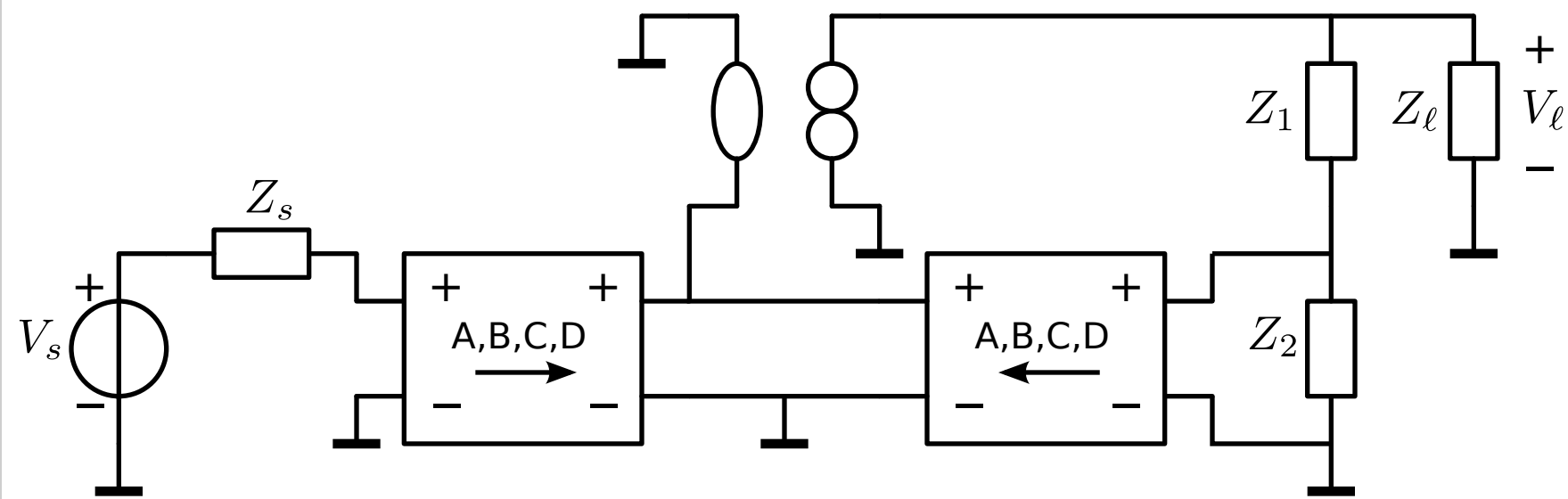
Voltage mirror



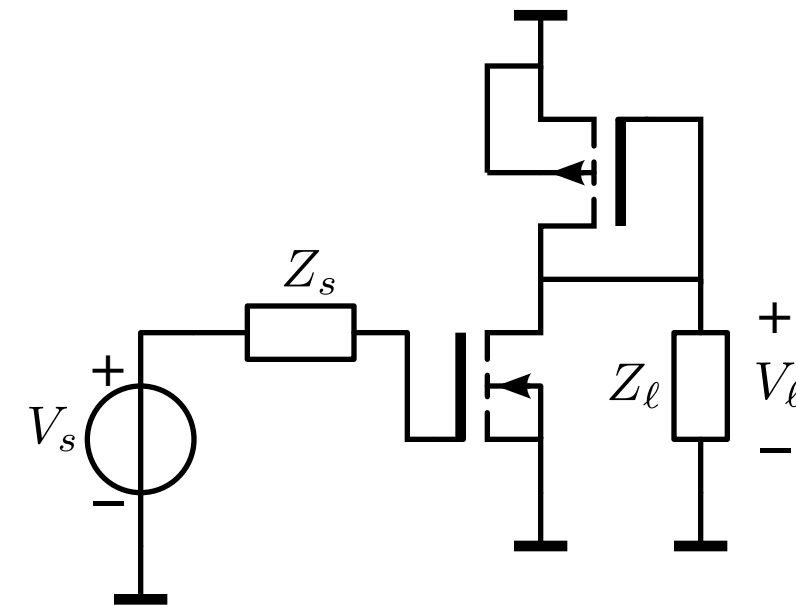
indirect voltage comparison:

# Indirect feedback voltage amplifier

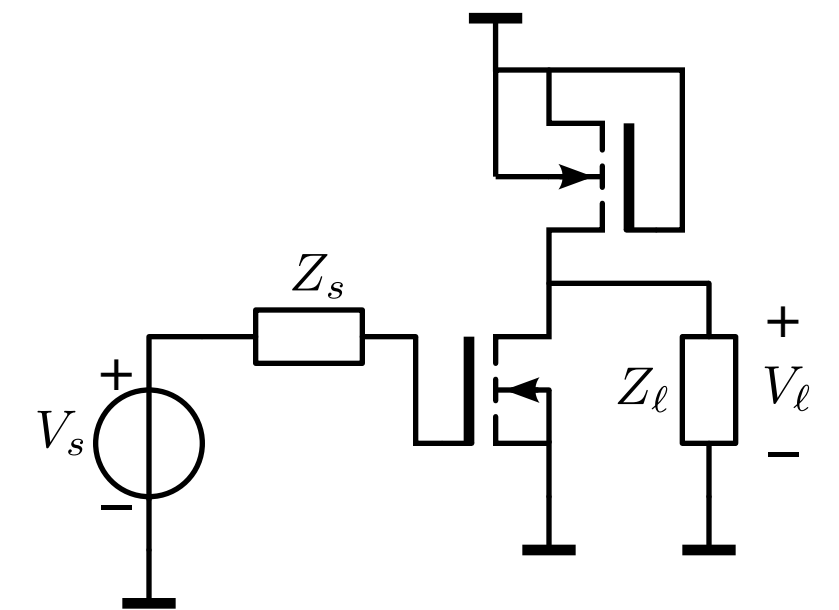
Inverting voltage amplifier  
indirect voltage comparison



Unity-gain  
Single-transistor  
controller



Voltage mirror

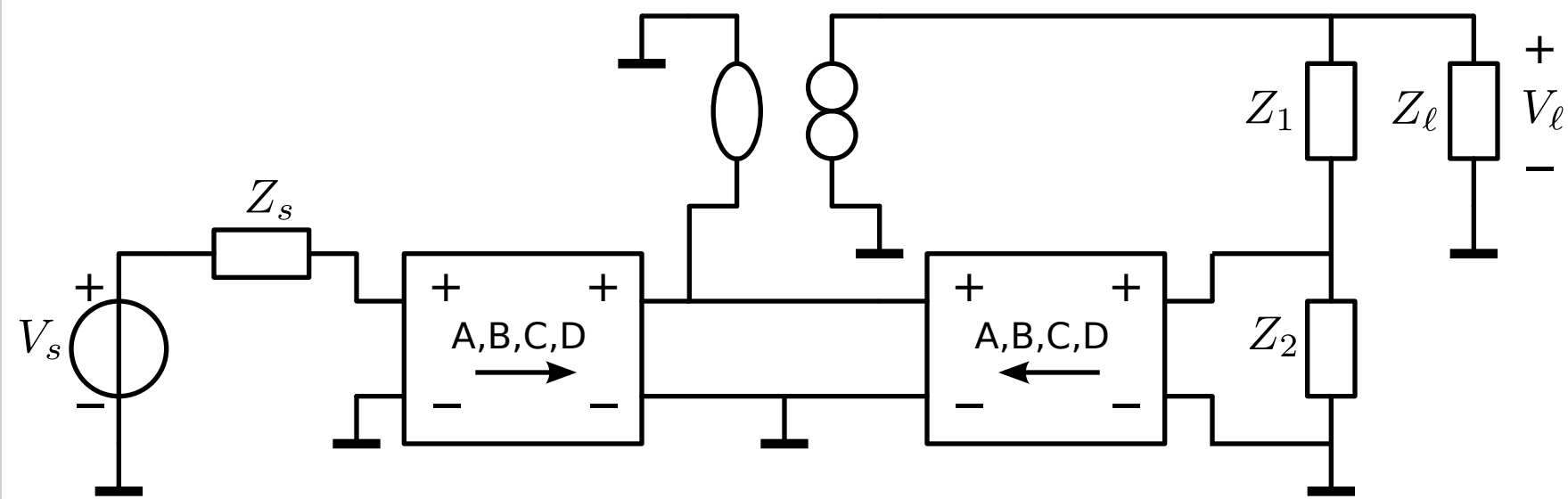


indirect voltage comparison:

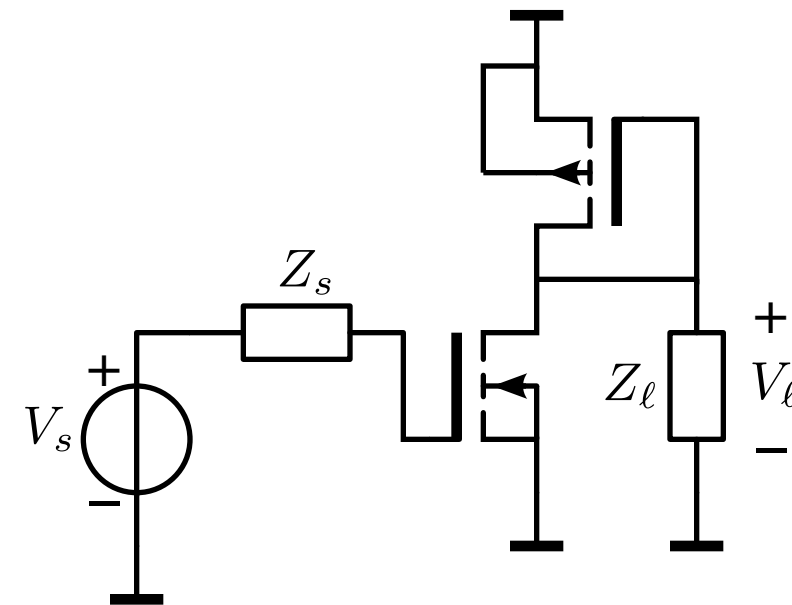
Feedback has no influence on the input impedance

# Indirect feedback voltage amplifier

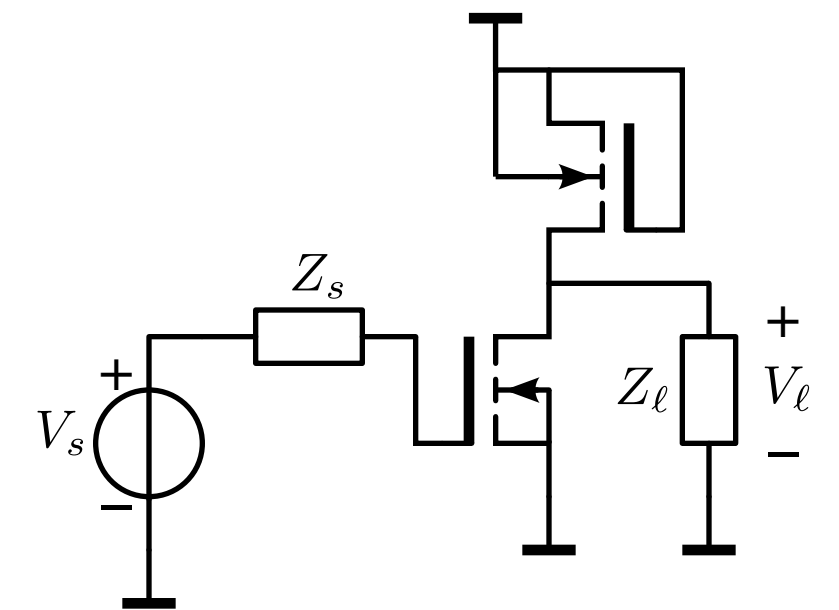
Inverting voltage amplifier  
indirect voltage comparison



Unity-gain  
Single-transistor  
controller



Voltage mirror



indirect voltage comparison:

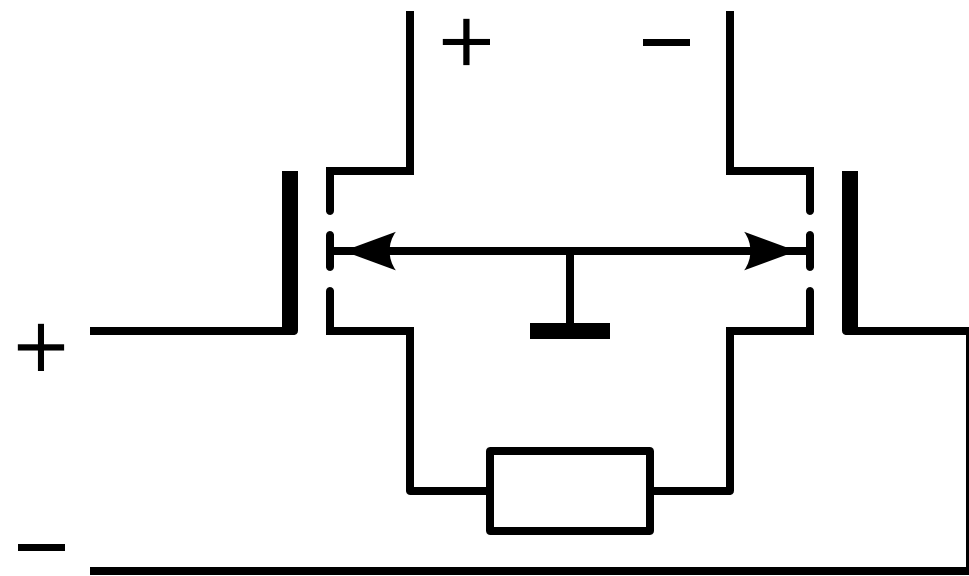
Feedback has no influence on the input impedance

# Balanced feedback stages



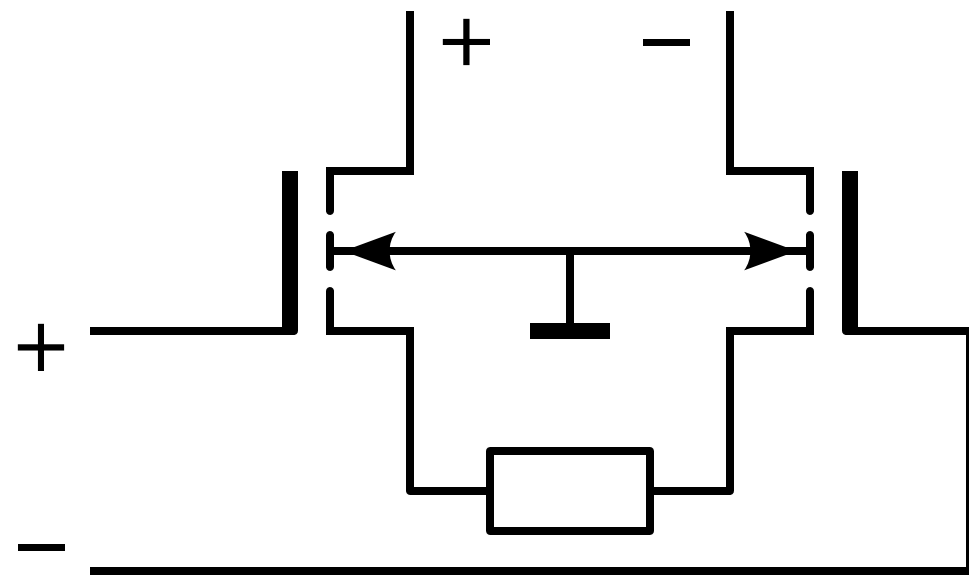
# Balanced feedback stages

Anti-series connected  
transadmittance stage

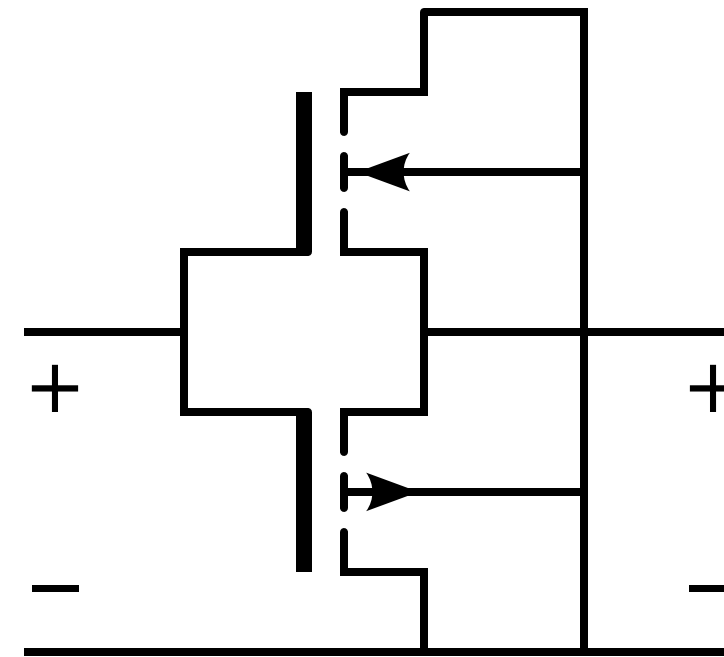


# Balanced feedback stages

Anti-series connected  
transadmittance stage

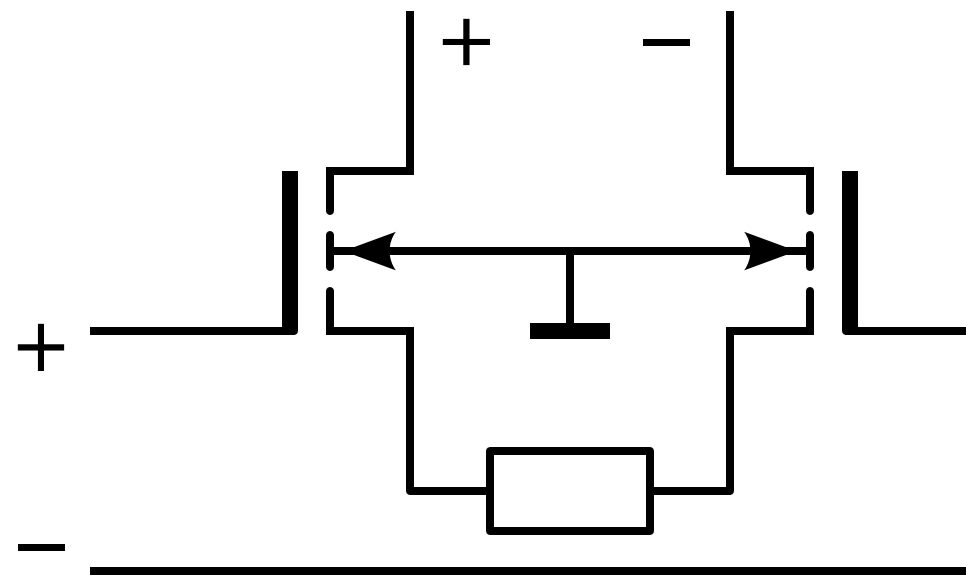


Complementary-parallel  
CD stage

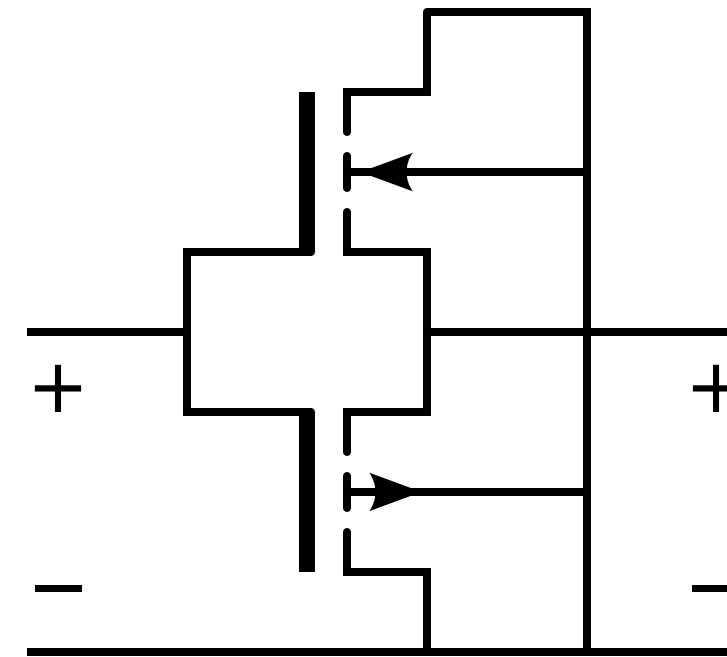


# Balanced feedback stages

Anti-series connected  
transadmittance stage



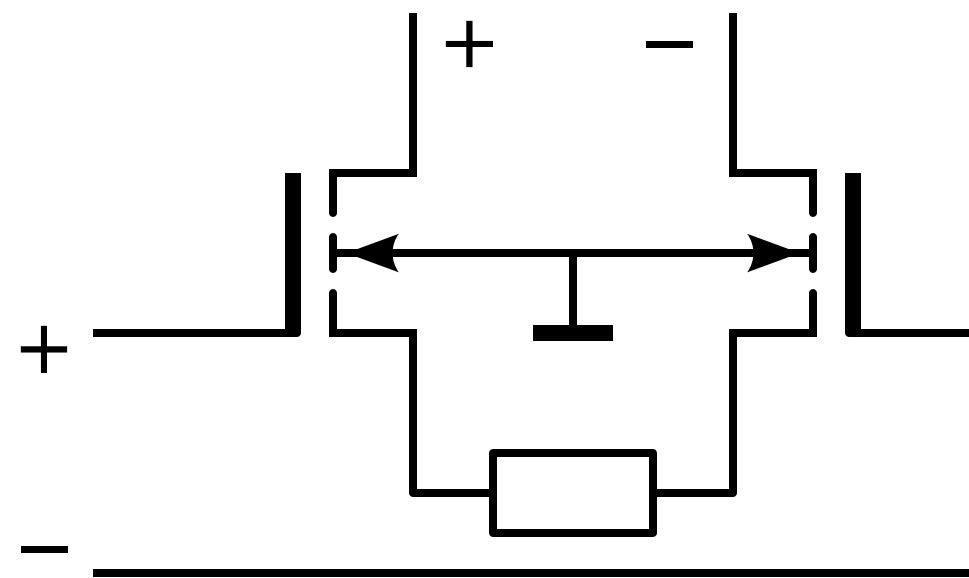
Complementary-parallel  
CD stage



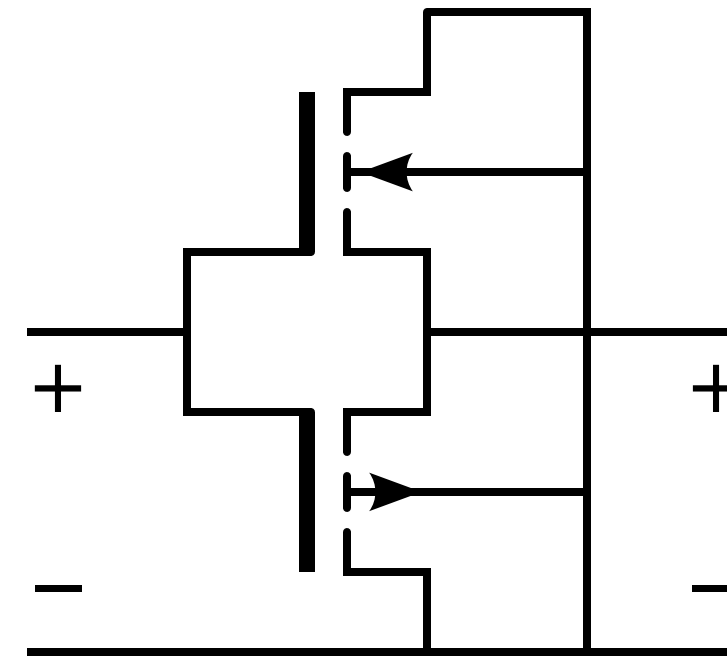
Behavioral modifications w.r.t. CS stage are a result of:

# Balanced feedback stages

Anti-series connected  
transadmittance stage



Complementary-parallel  
CD stage

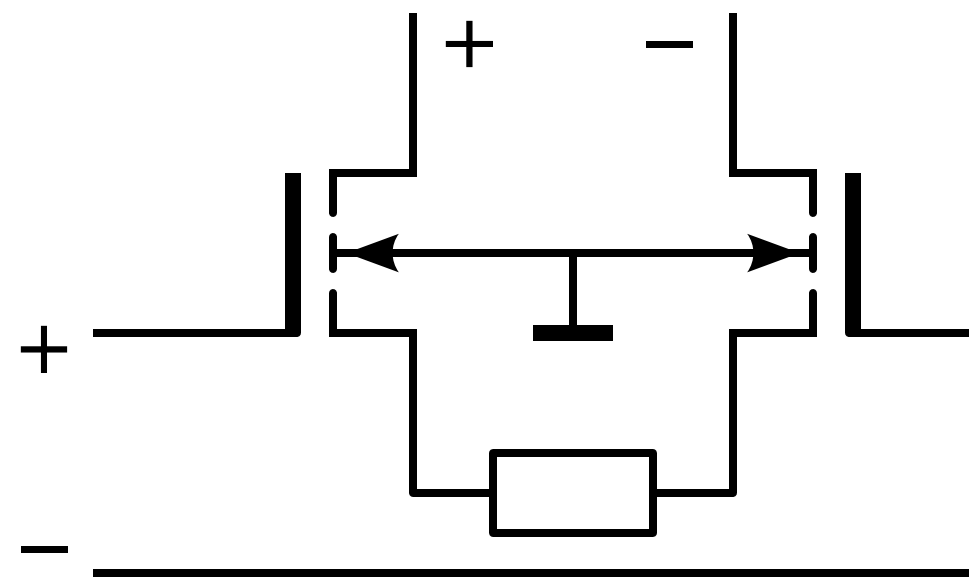


Behavioral modifications w.r.t. CS stage are a result of:

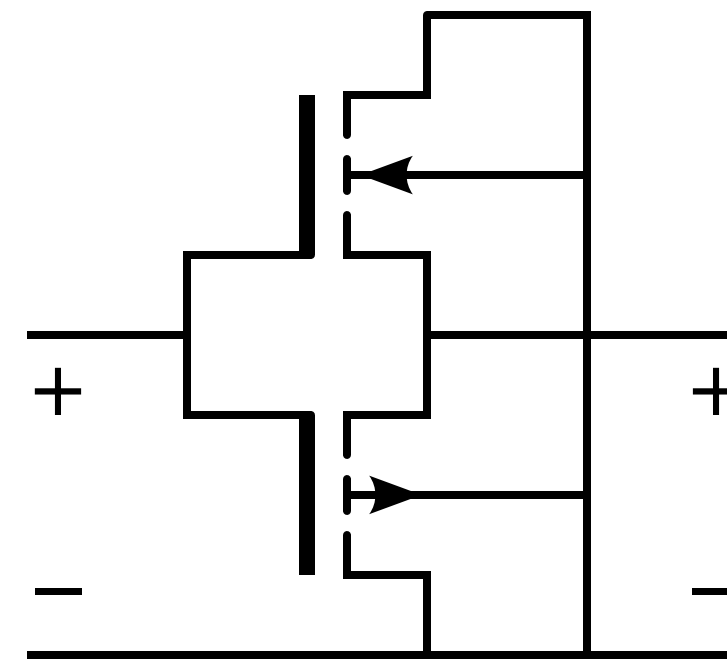
Application of negative feedback

# Balanced feedback stages

Anti-series connected  
transadmittance stage



Complementary-parallel  
CD stage



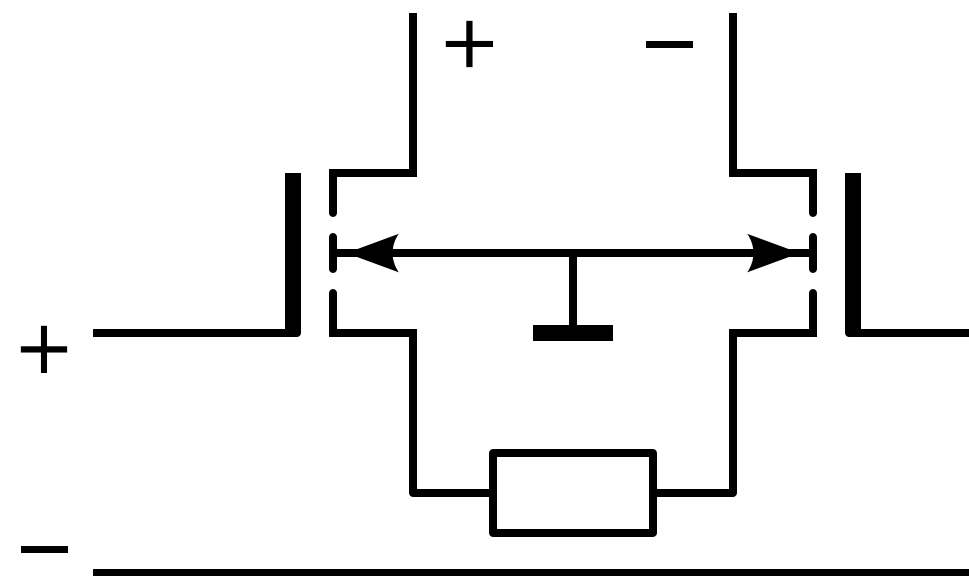
Behavioral modifications w.r.t. CS stage are a result of:

Application of negative feedback

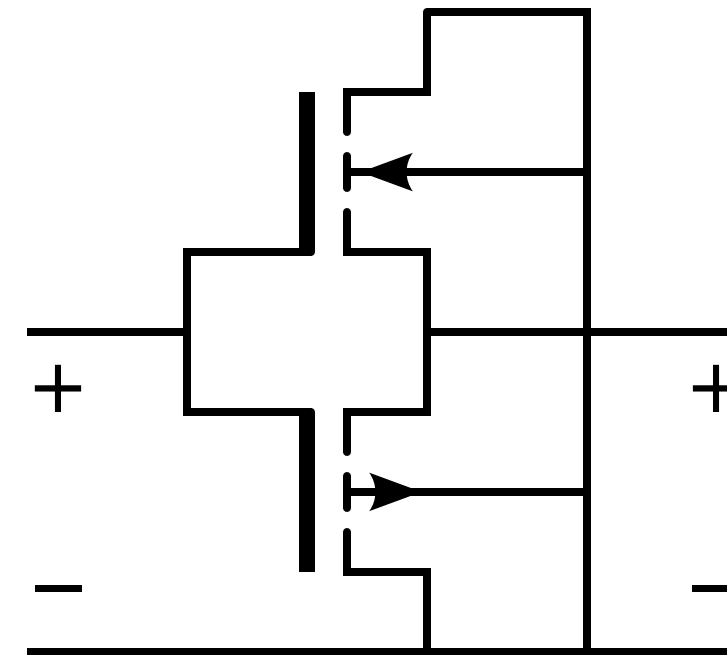
Application of balancing

# Balanced feedback stages

Anti-series connected  
transadmittance stage



Complementary-parallel  
CD stage



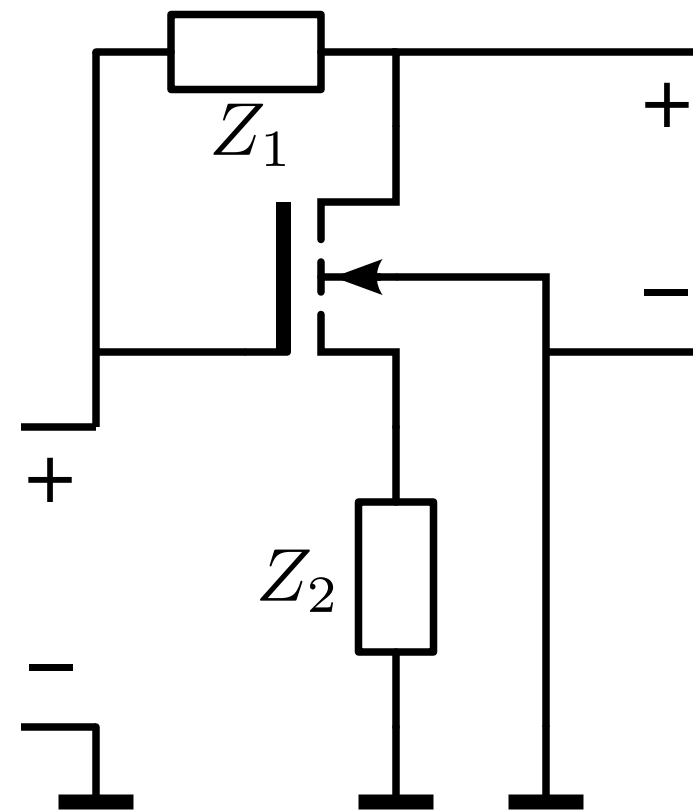
Behavioral modifications w.r.t. CS stage are a result of:

- Application of negative feedback
- Application of balancing

# Multiple-loop feedback stages

# Multiple-loop feedback stages

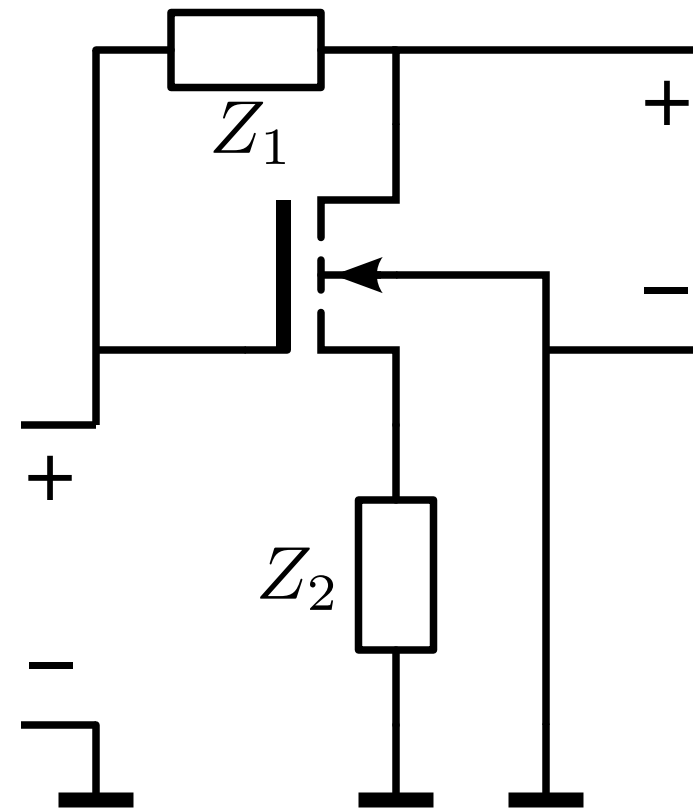
B,C



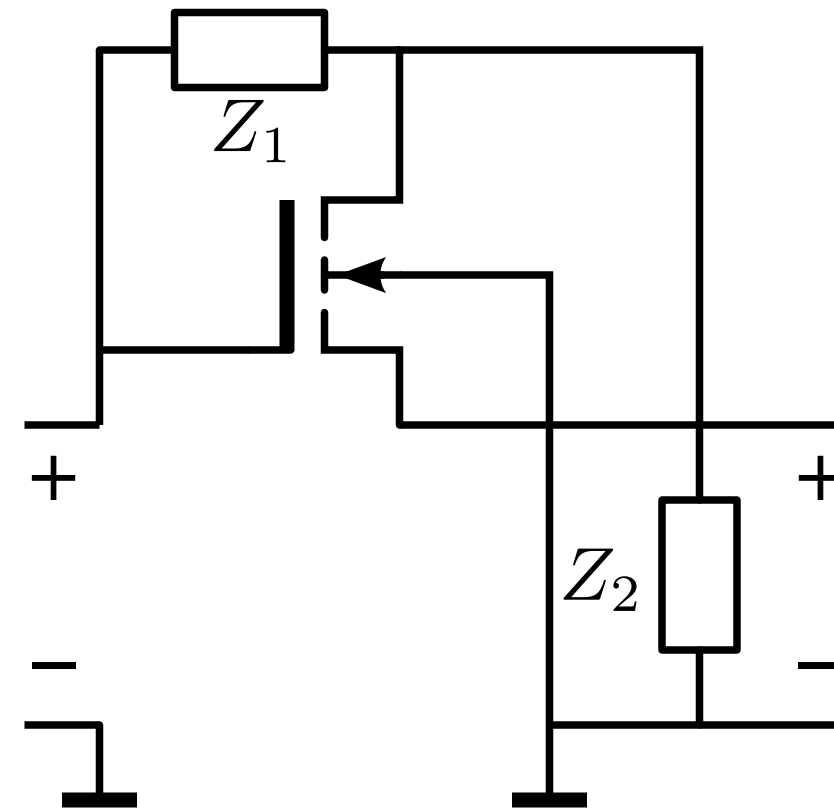


# Multiple-loop feedback stages

B,C

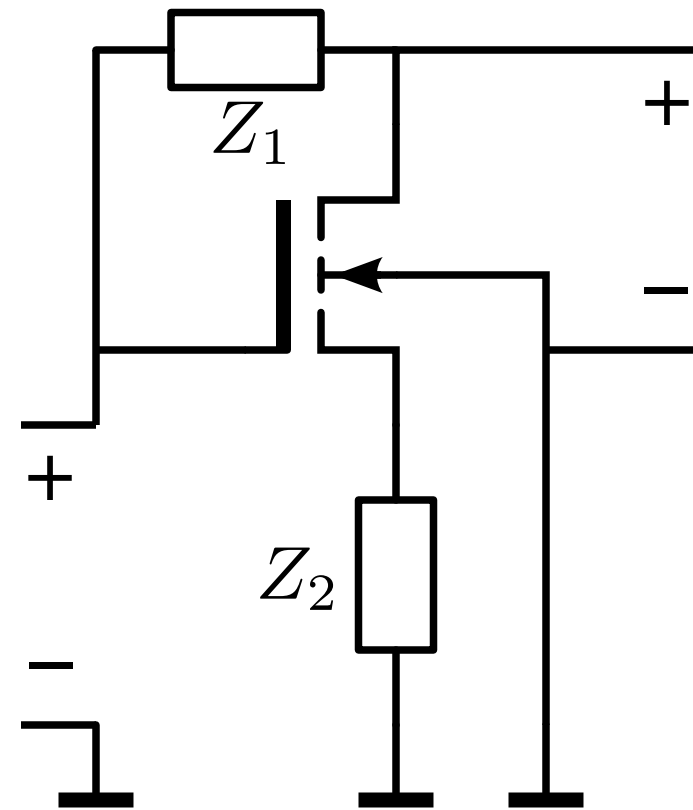


A=1, D

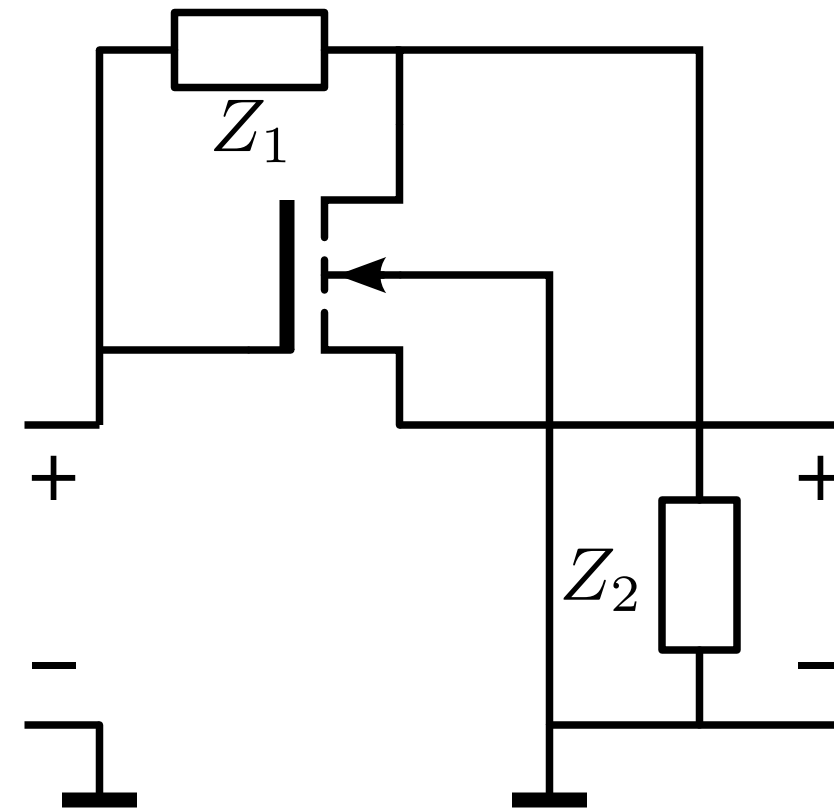


# Multiple-loop feedback stages

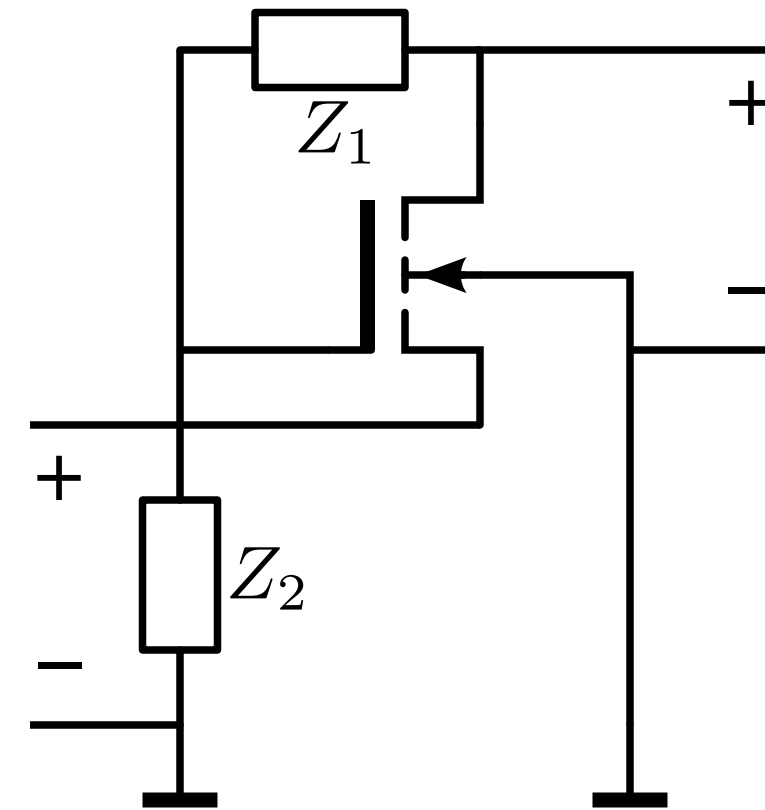
B,C



A=1, D

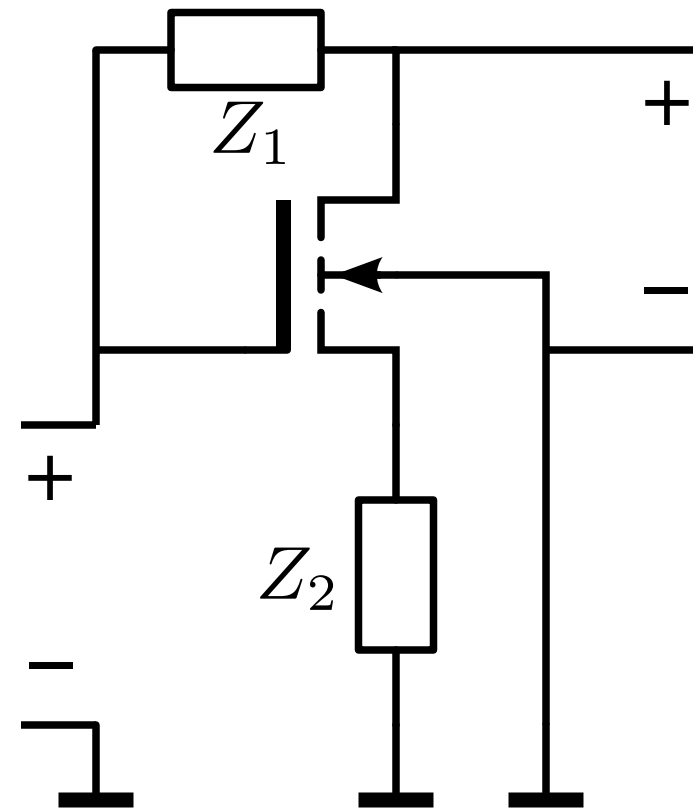


A, D=1

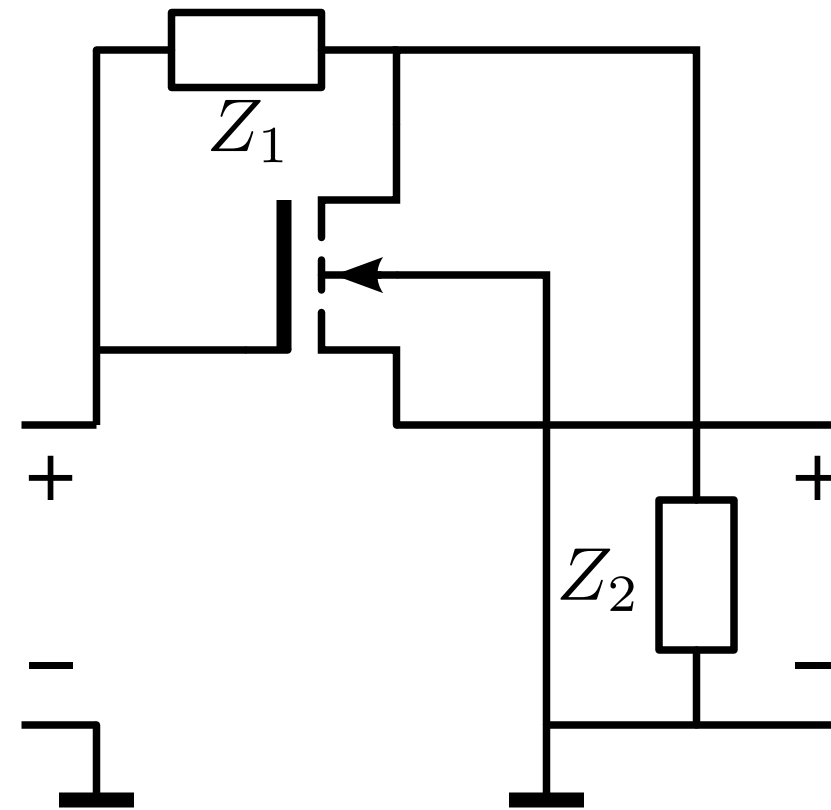


# Multiple-loop feedback stages

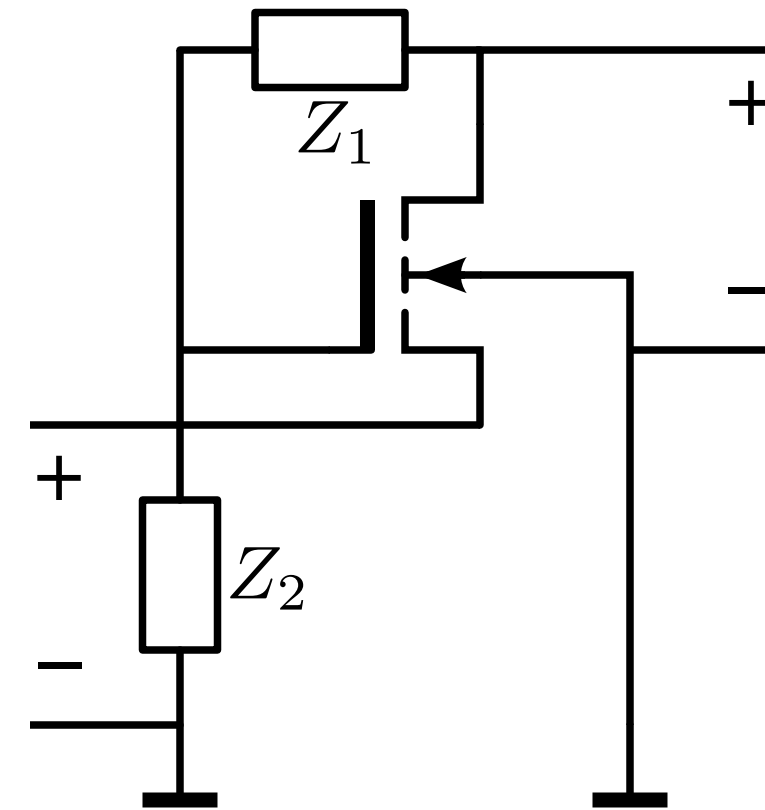
B,C



A=1, D



A, D=1



There is more

# There is more

Combinations of different techniques:

# There is more

Combinations of different techniques:

Feedback techniques:

# There is more

Combinations of different techniques:

Feedback techniques:

direct feedback

# There is more

Combinations of different techniques:

Feedback techniques:

direct feedback

indirect feedback



# There is more

Combinations of different techniques:

Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

# There is more

Combinations of different techniques:

Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

passive feedback

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

passive feedback

active feedback

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

passive feedback

active feedback

### Balancing techniques:

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

passive feedback

active feedback

### Balancing techniques:

anti-series or complementary series

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

indirect feedback

nonenergetic feedback

passive feedback

active feedback

### Balancing techniques:

anti-series or complementary series

anti-parallel or complementary parallel

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

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nonenergetic feedback

passive feedback

active feedback

### Balancing techniques:

anti-series or complementary series

anti-parallel or complementary parallel

There is even more ...

# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

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### Balancing techniques:

anti-series or complementary series

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There is even more ...

Keep following 'Structured Electronic Design'!



# There is more

## Combinations of different techniques:

### Feedback techniques:

direct feedback

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nonenergetic feedback

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active feedback

### Balancing techniques:

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There is even more ...

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