

# Structured Electronic Design

## Design of Single-loop Negative Feedback Amplifier Configurations

# Negative Feedback Amplifier Configurations

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
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# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
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V

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V			

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier		

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback



# Negative Feedback Amplifier Configurations

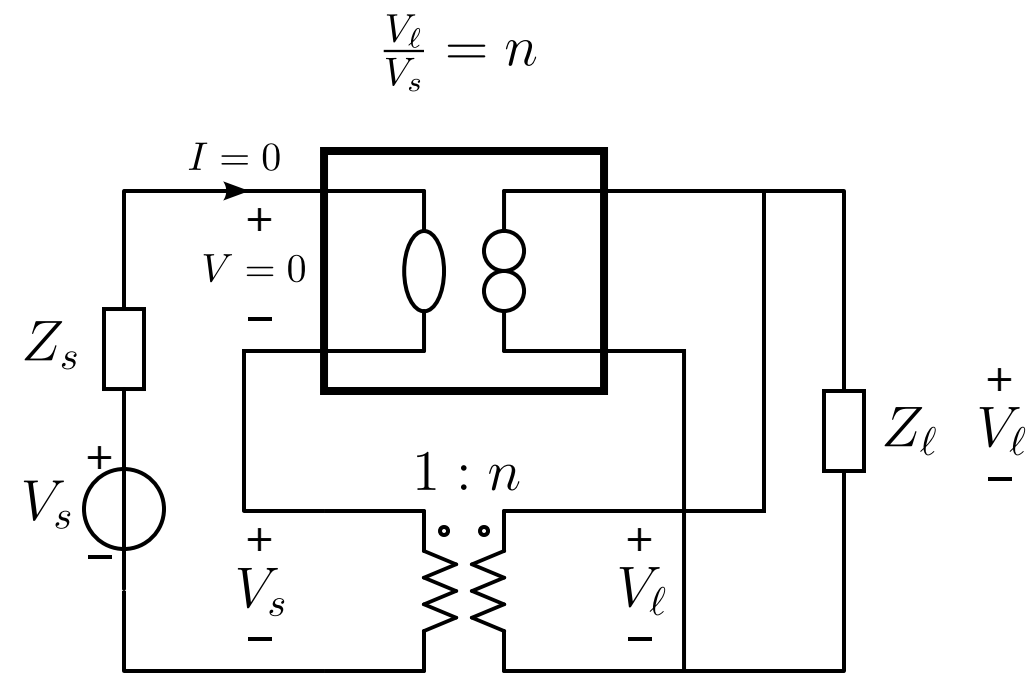
Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback

# Negative Feedback Voltage Amplifier Configurations

# Negative Feedback Voltage Amplifier Configurations

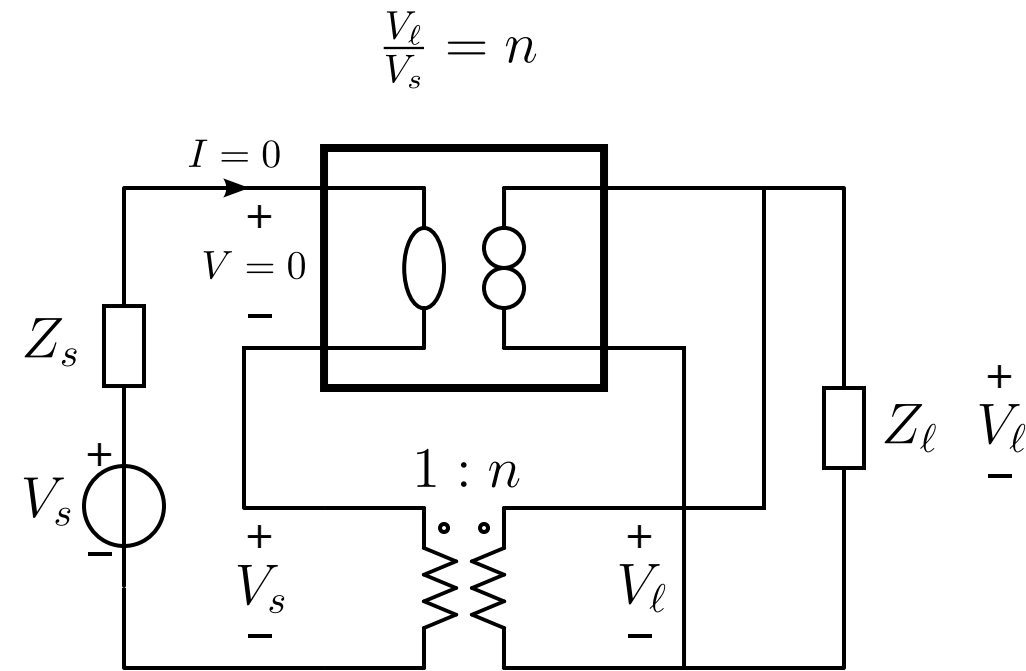
Nonenergic feedback amplifier

# Negative Feedback Voltage Amplifier Configurations



Nonenergic feedback amplifier

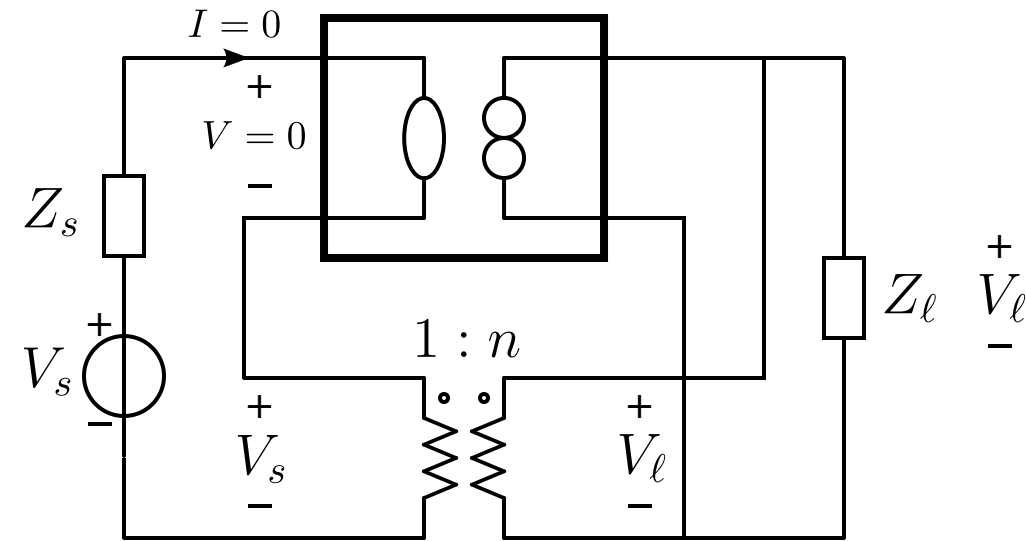
# Negative Feedback Voltage Amplifier Configurations



Nonenergic feedback amplifier  
- port isolation

# Negative Feedback Voltage Amplifier Configurations

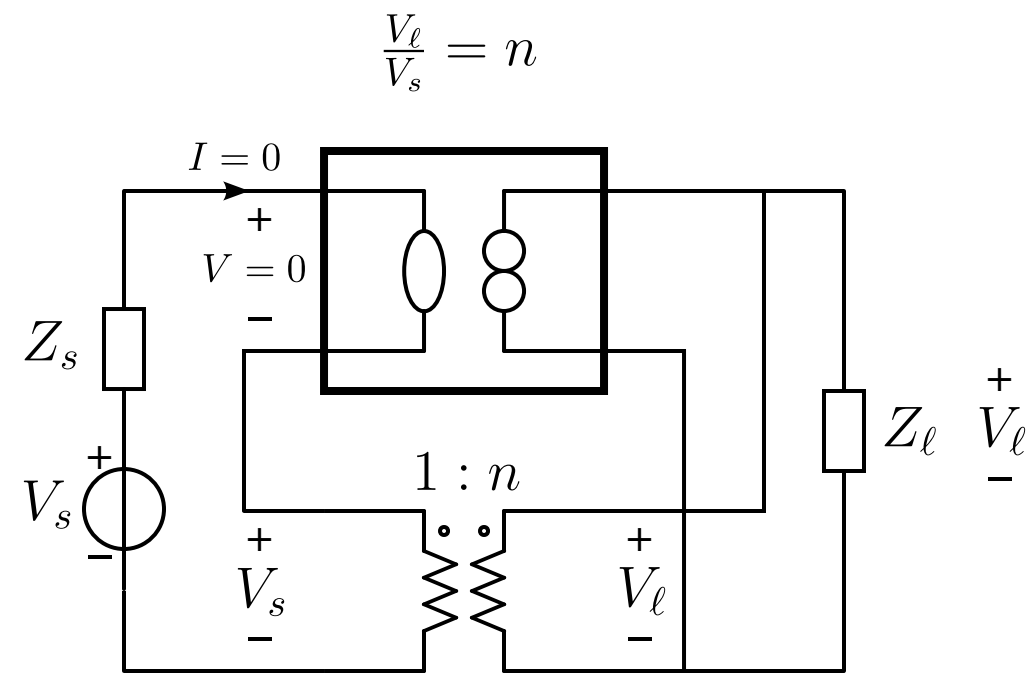
$$\frac{V_\ell}{V_s} = n$$



# Nonenergetic feedback amplifier

- port isolation
- inverting or noninverting

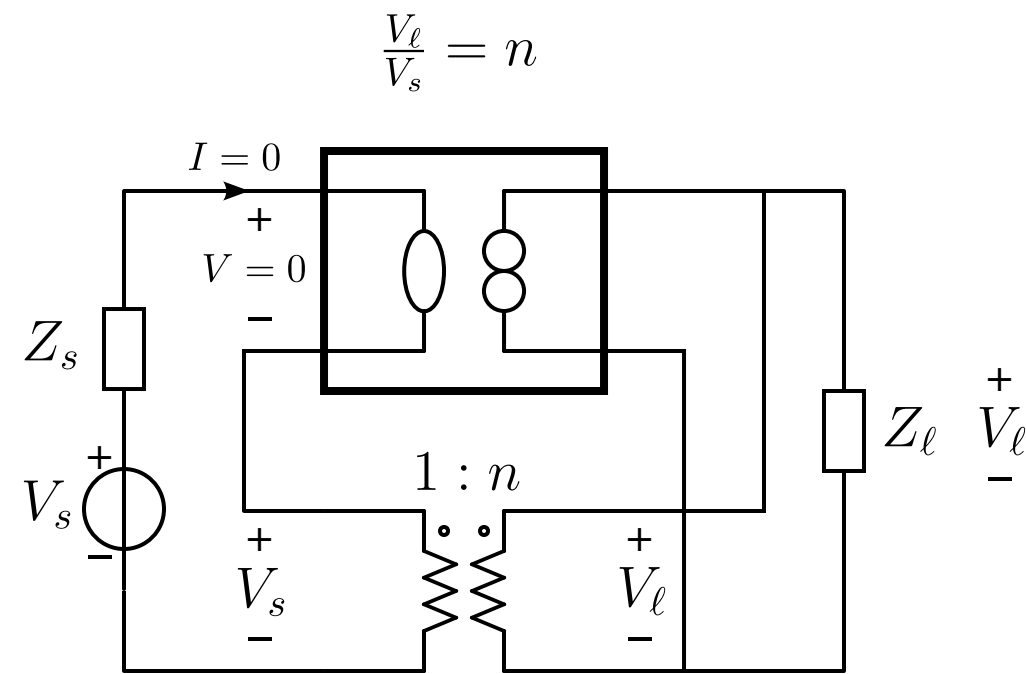
# Negative Feedback Voltage Amplifier Configurations



Nonenergetic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

# Negative Feedback Voltage Amplifier Configurations



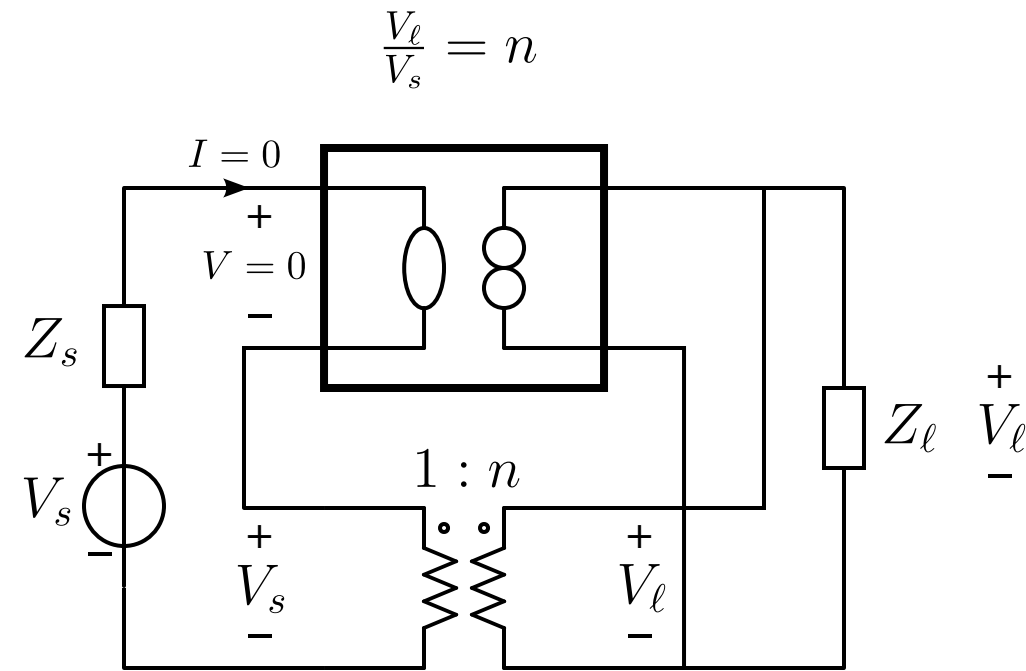
Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

Nonenergic feedback follower



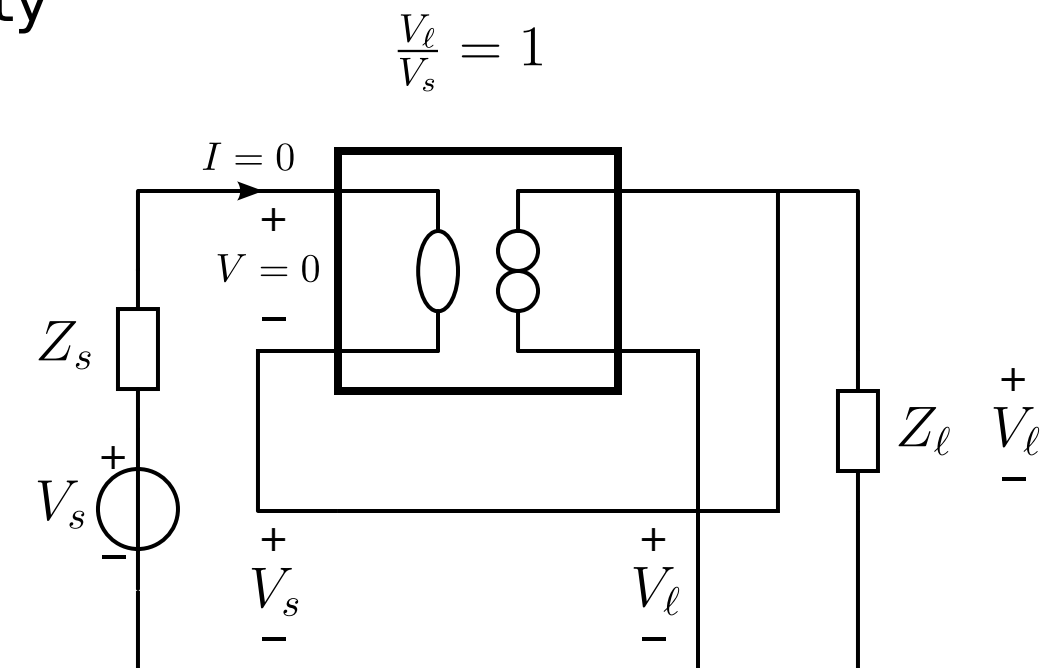
# Negative Feedback Voltage Amplifier Configurations



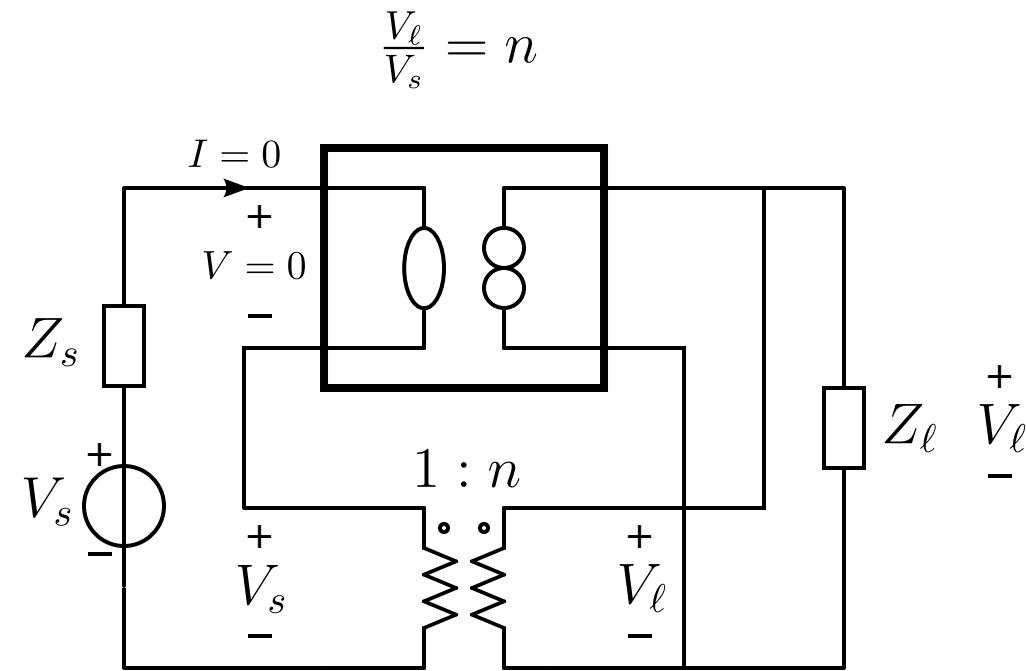
## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower



# Negative Feedback Voltage Amplifier Configurations

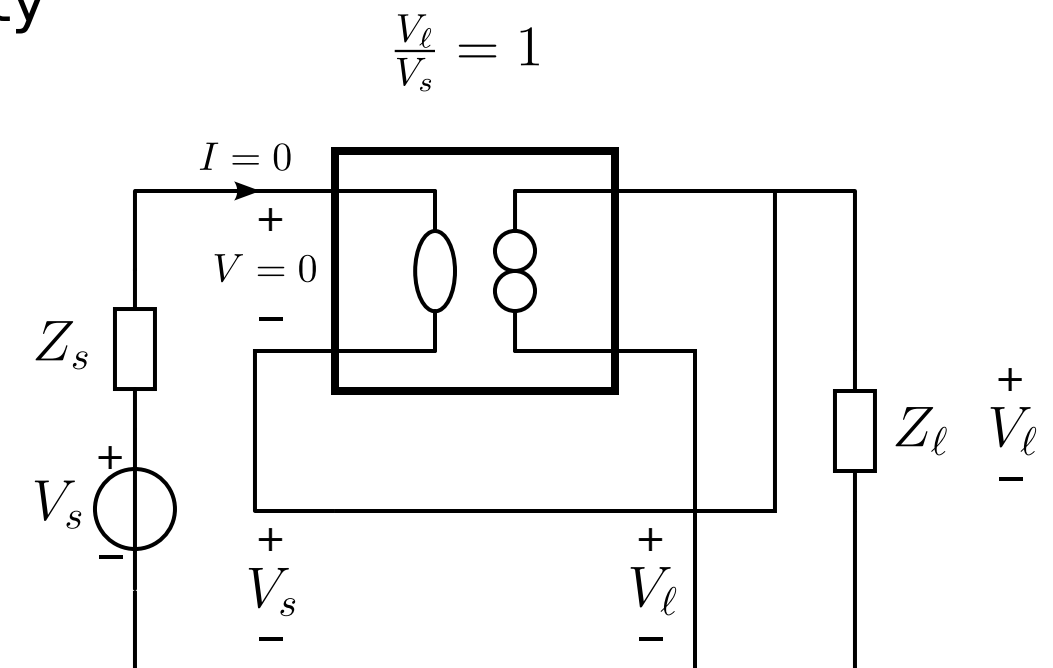


Nonenergic feedback amplifier

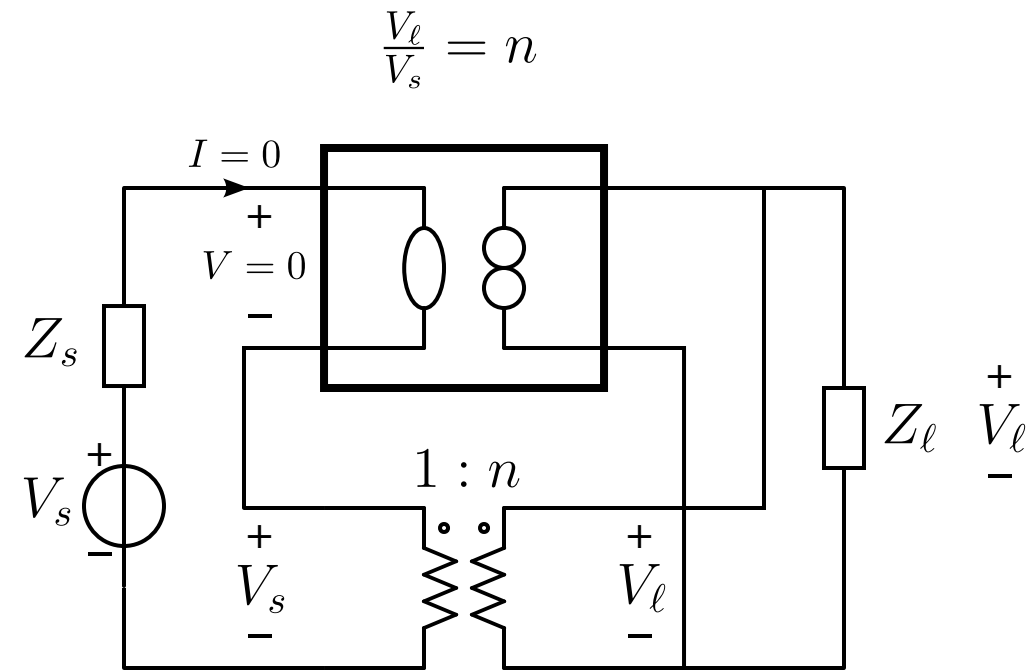
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

Nonenergic feedback follower

- no port isolation



# Negative Feedback Voltage Amplifier Configurations

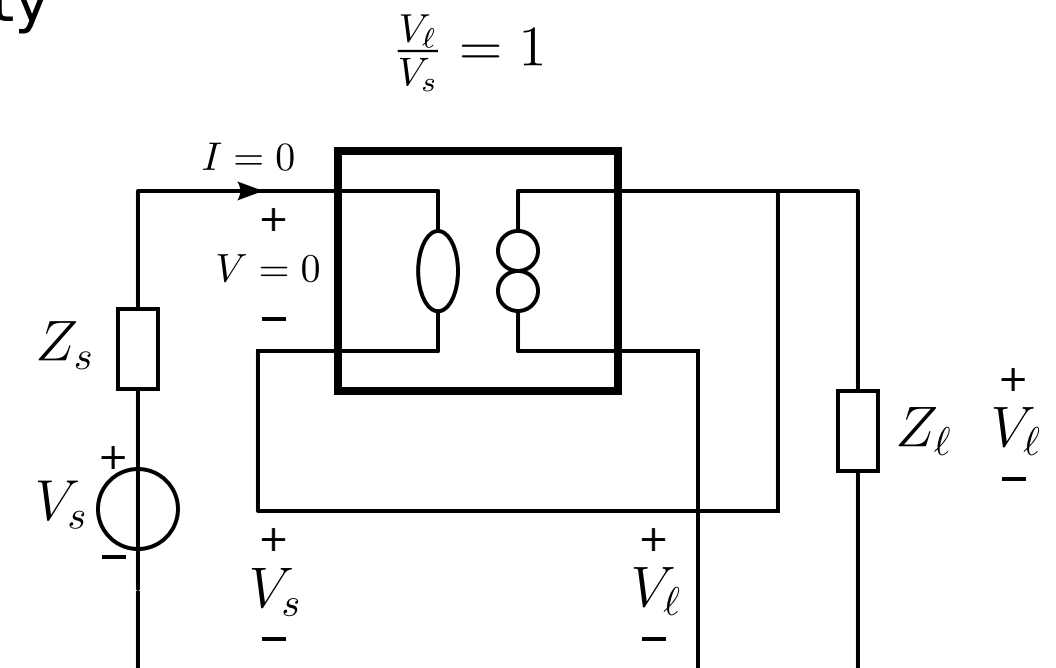


## Nonenergic feedback amplifier

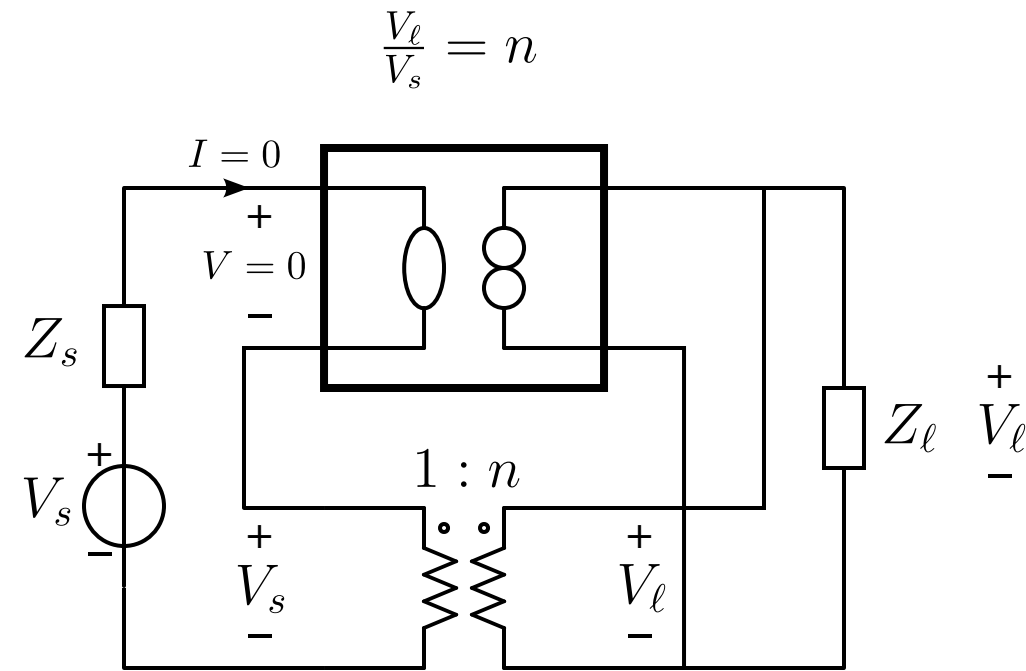
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

- no port isolation
- **noninverting**



# Negative Feedback Voltage Amplifier Configurations

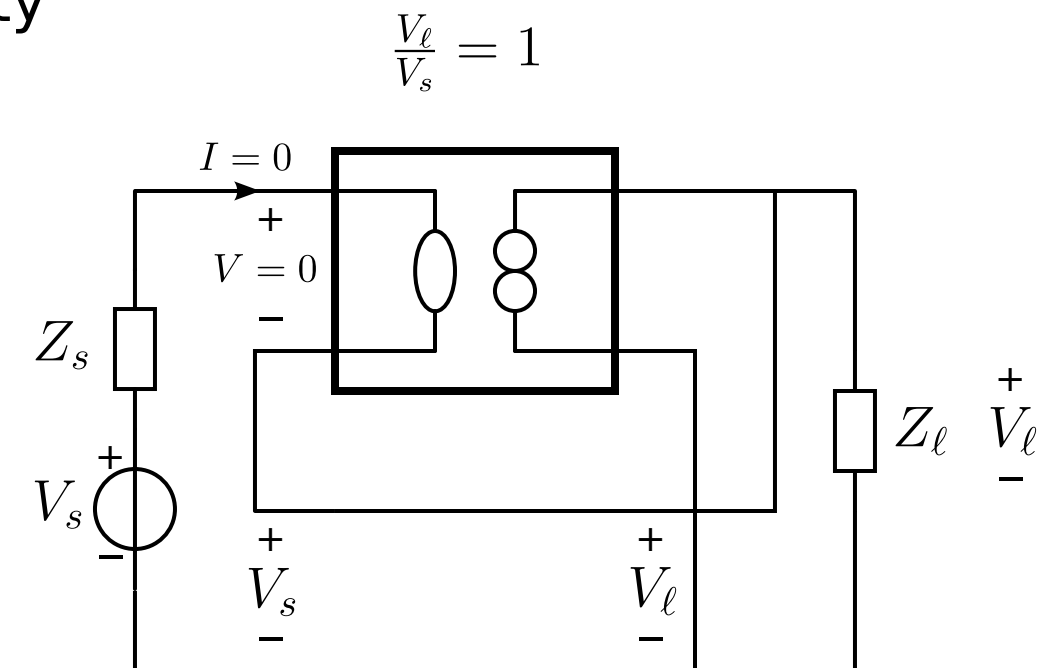


## Nonenergic feedback amplifier

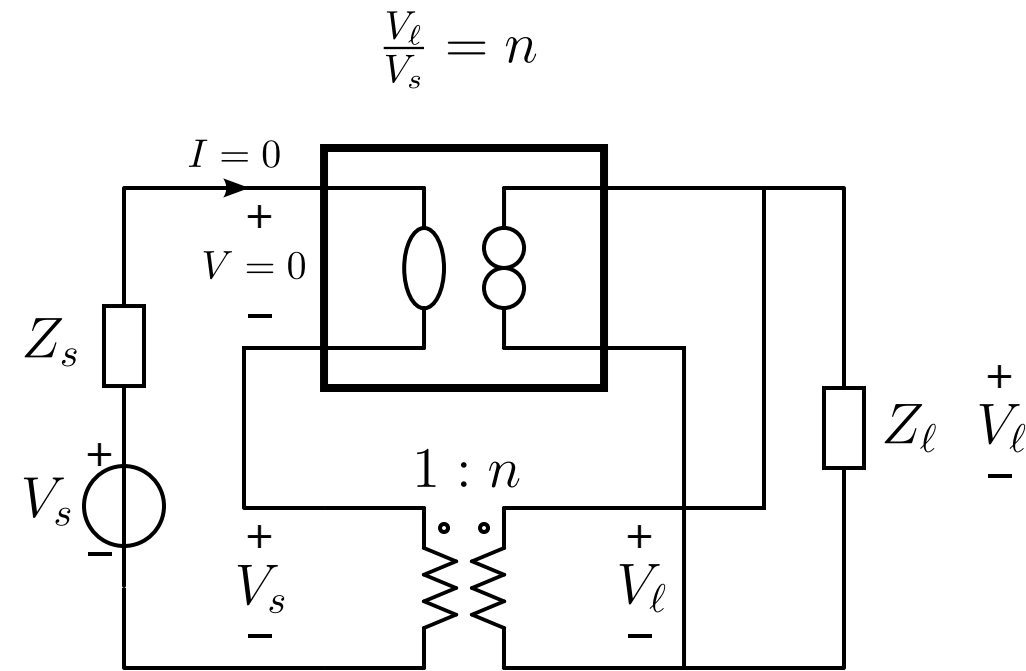
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity



# Negative Feedback Voltage Amplifier Configurations

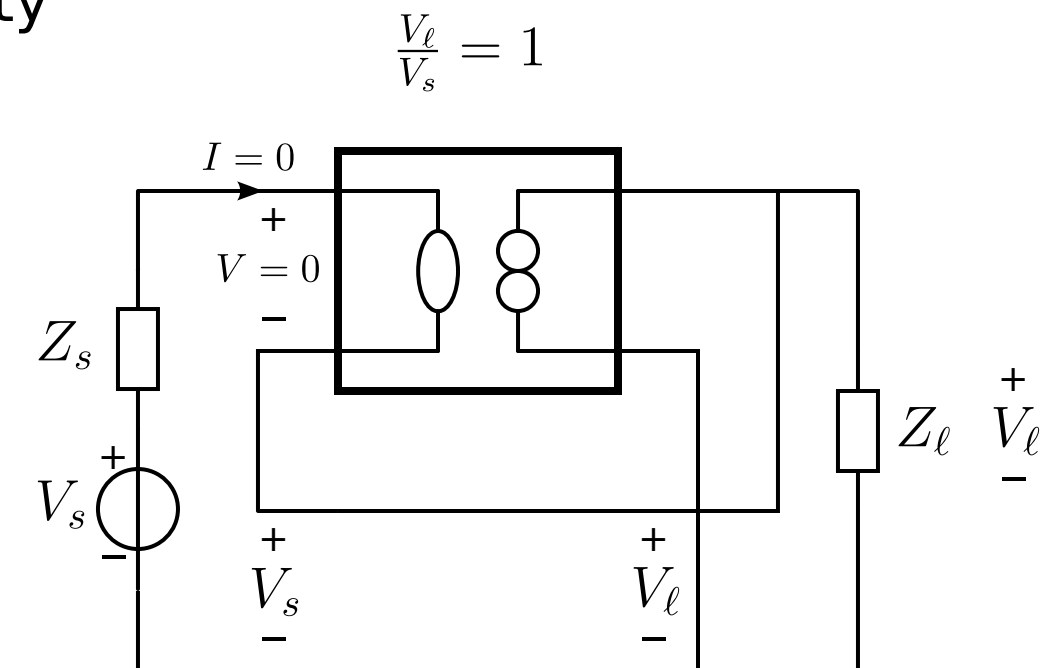


## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

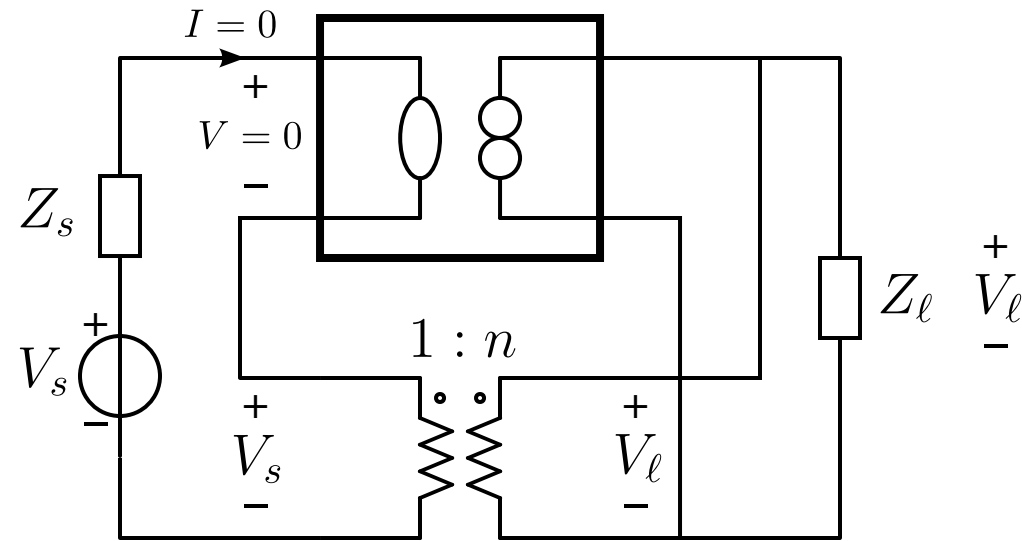
- no port isolation
- noninverting
- gain equals unity



## Passive feedback amplifier

# Negative Feedback Voltage Amplifier Configurations

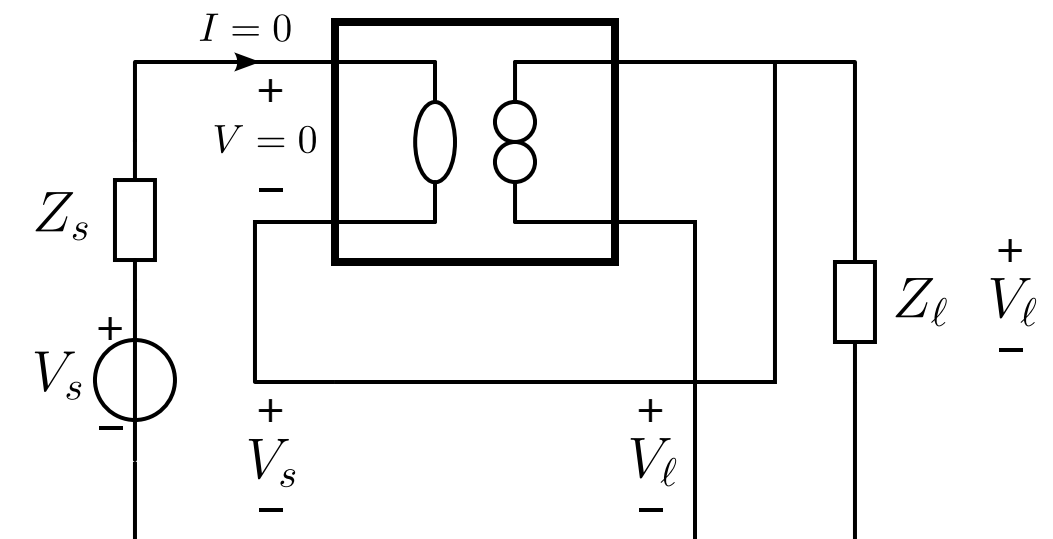
$$\frac{V_\ell}{V_s} = n$$



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

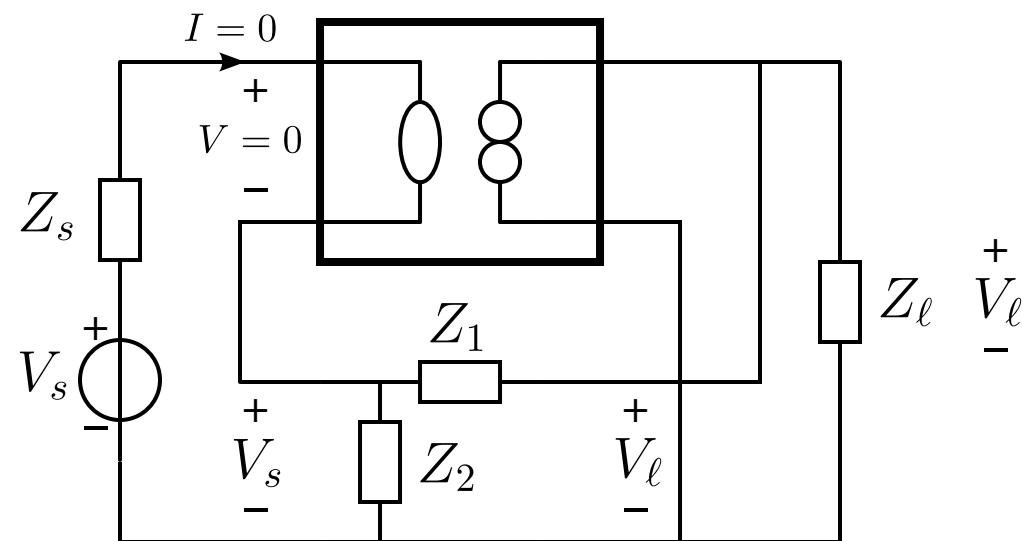
$$\frac{V_\ell}{V_s} = 1$$



Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

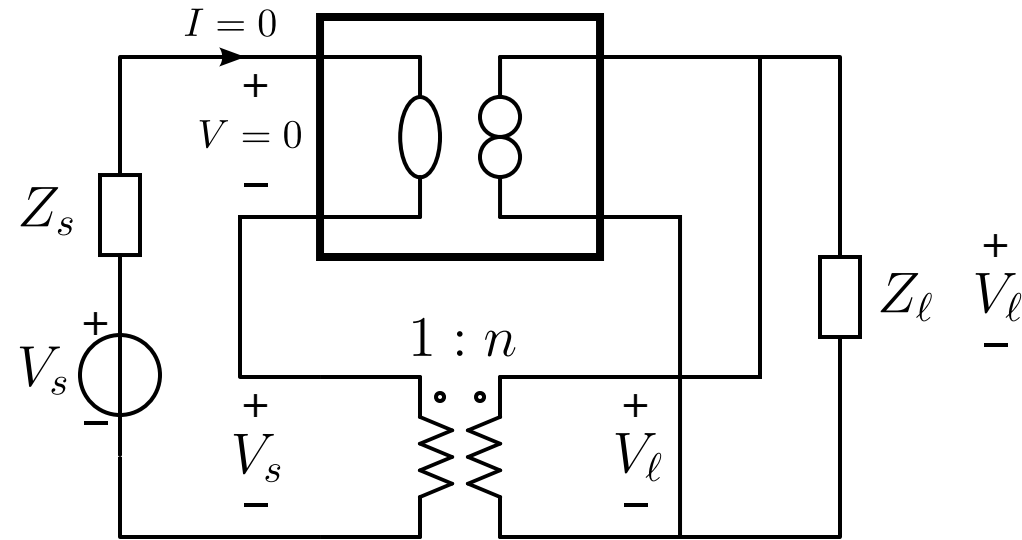
$$\frac{V_\ell}{V_s} = \frac{Z_1 + Z_2}{Z_2}$$



Passive feedback amplifier

# Negative Feedback Voltage Amplifier Configurations

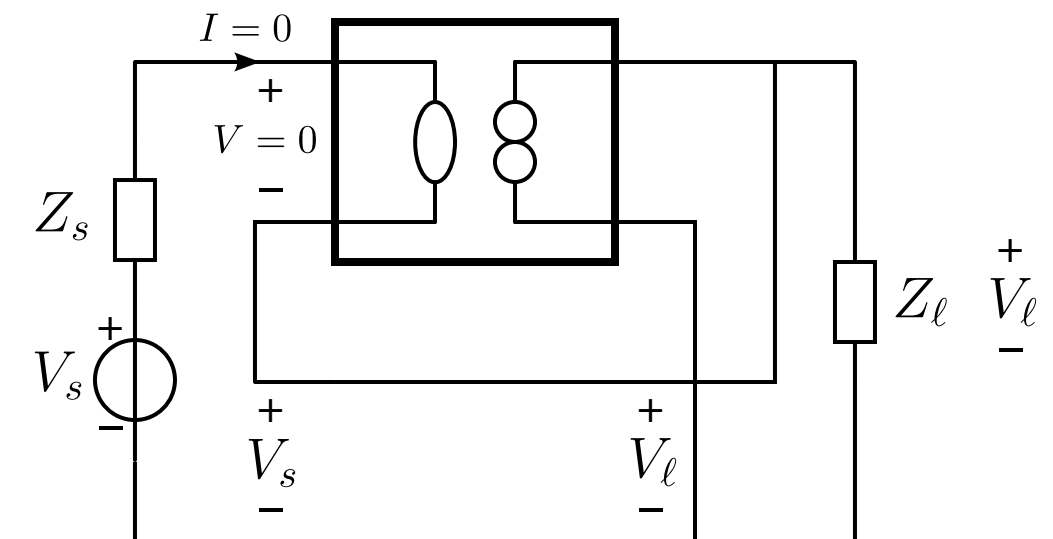
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Nonenergic feedback amplifier

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- inverting or noninverting
- gain less, equal or larger than unity

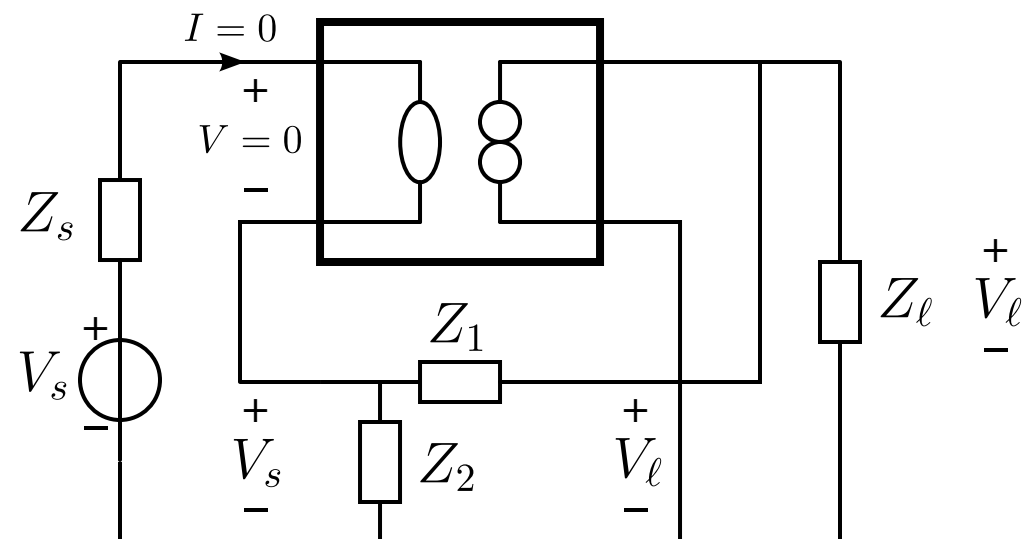
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Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

$$\frac{V_\ell}{V_s} = \frac{Z_1 + Z_2}{Z_2}$$

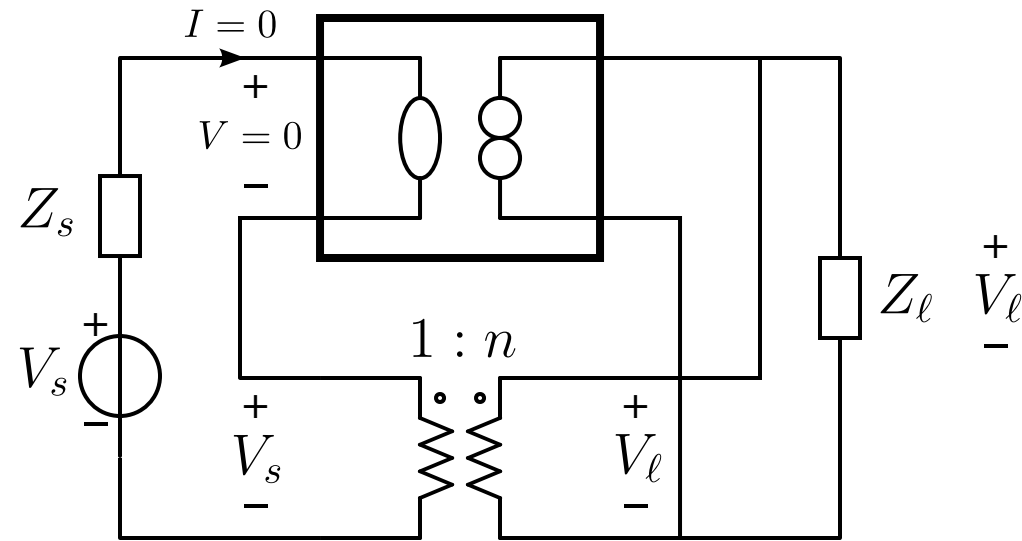


Passive feedback amplifier

- no port isolation

# Negative Feedback Voltage Amplifier Configurations

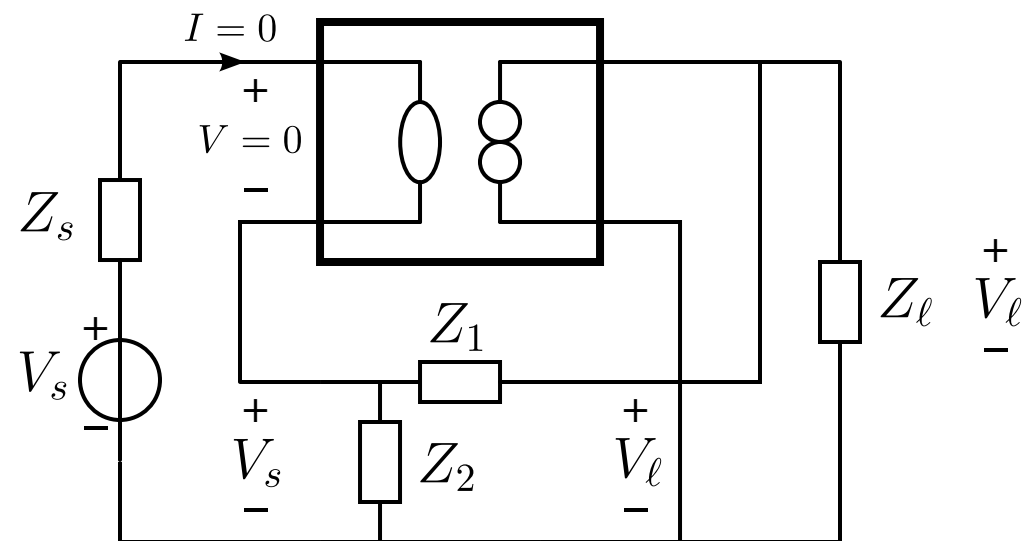
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## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

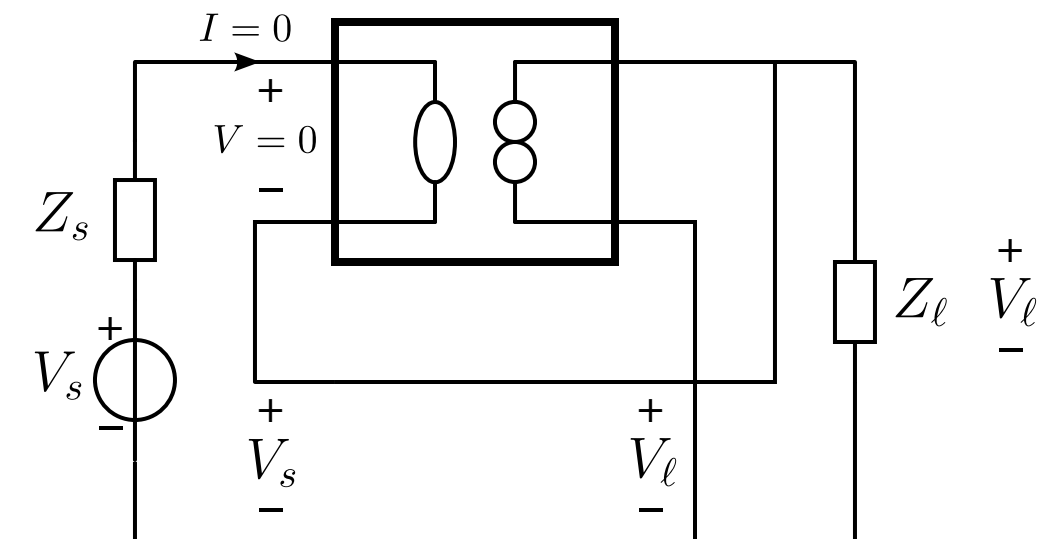
$$\frac{V_\ell}{V_s} = \frac{Z_1 + Z_2}{Z_2}$$



## Passive feedback amplifier

- no port isolation
- noninverting

$$\frac{V_\ell}{V_s} = 1$$



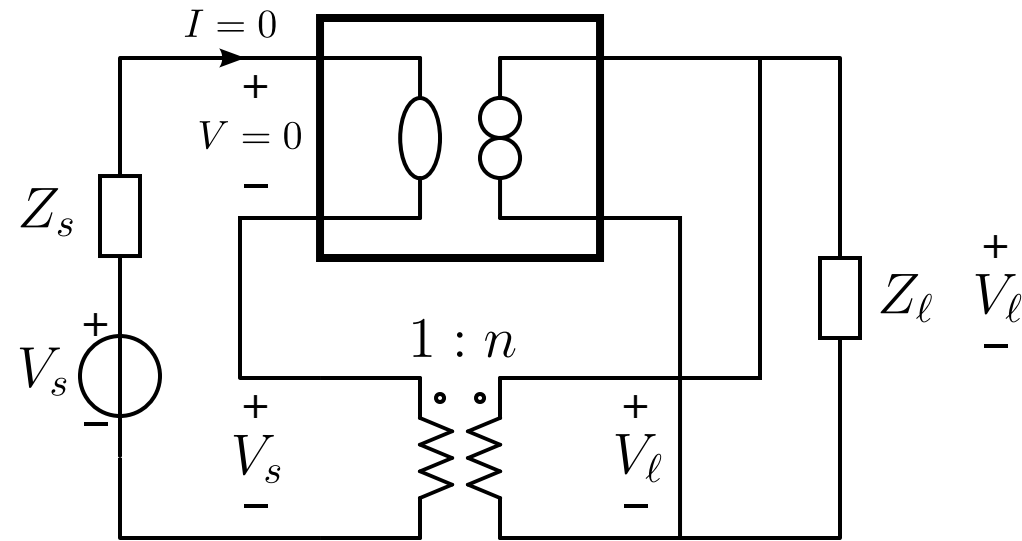
## Nonenergic feedback follower

- no port isolation
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# Negative Feedback Voltage Amplifier Configurations

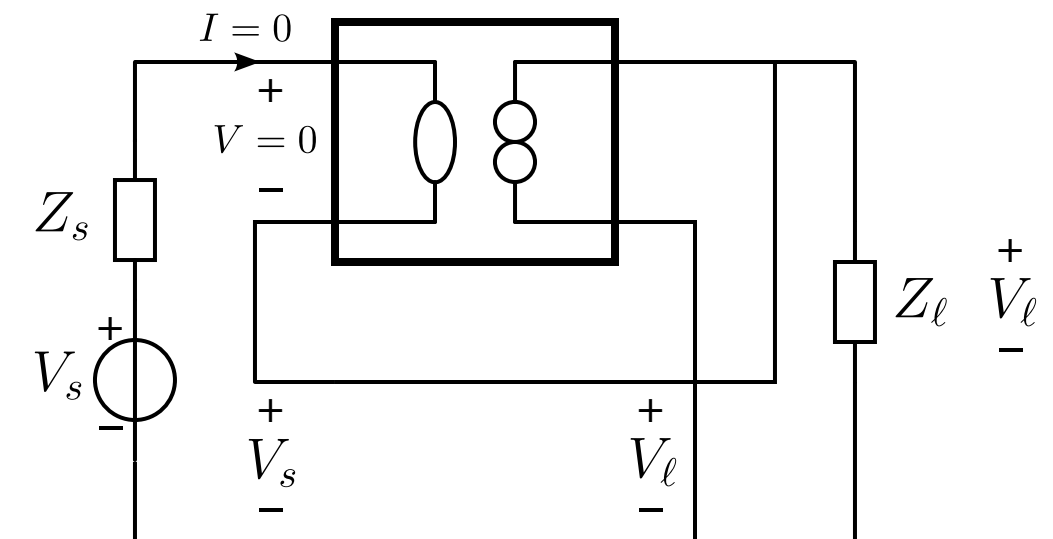
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## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
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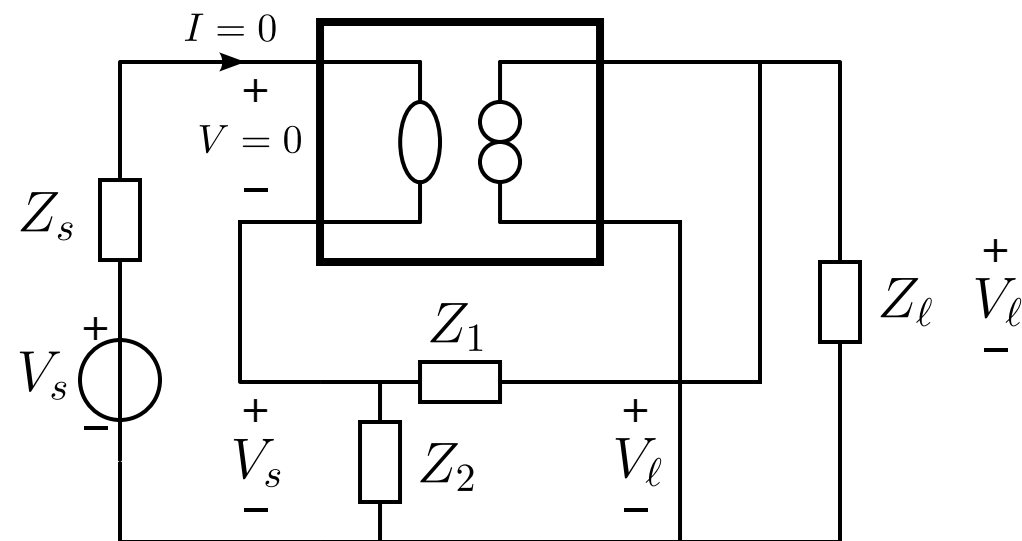
$$\frac{V_\ell}{V_s} = 1$$



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

$$\frac{V_\ell}{V_s} = \frac{Z_1 + Z_2}{Z_2}$$

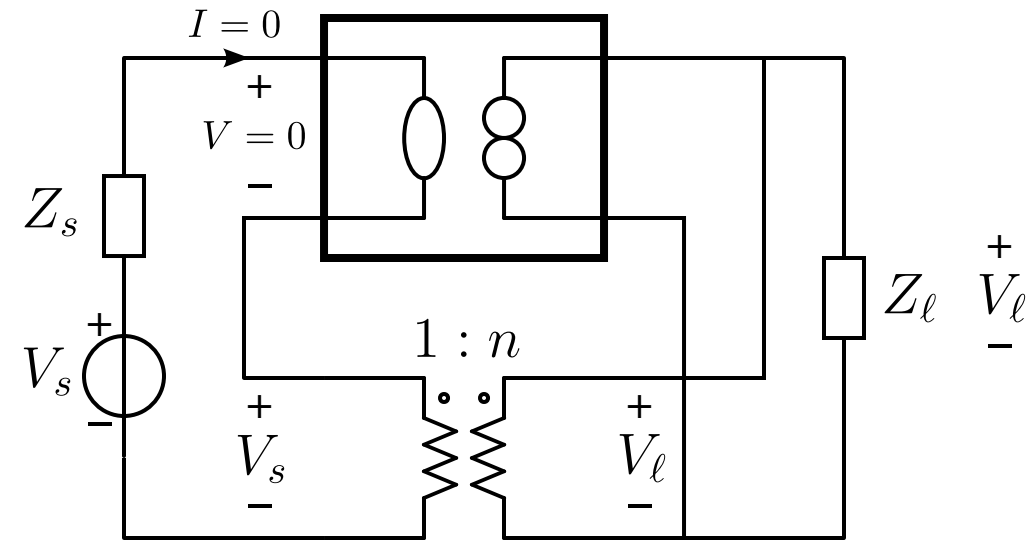


## Passive feedback amplifier

- no port isolation
- noninverting
- gain larger than unity

# Negative Feedback Voltage Amplifier Configurations

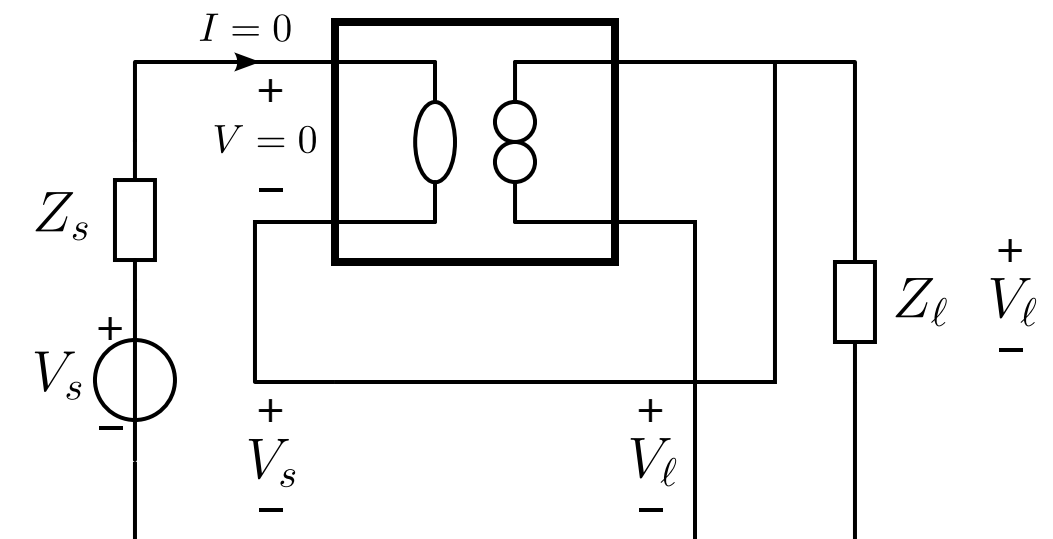
$$\frac{V_\ell}{V_s} = n$$



## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

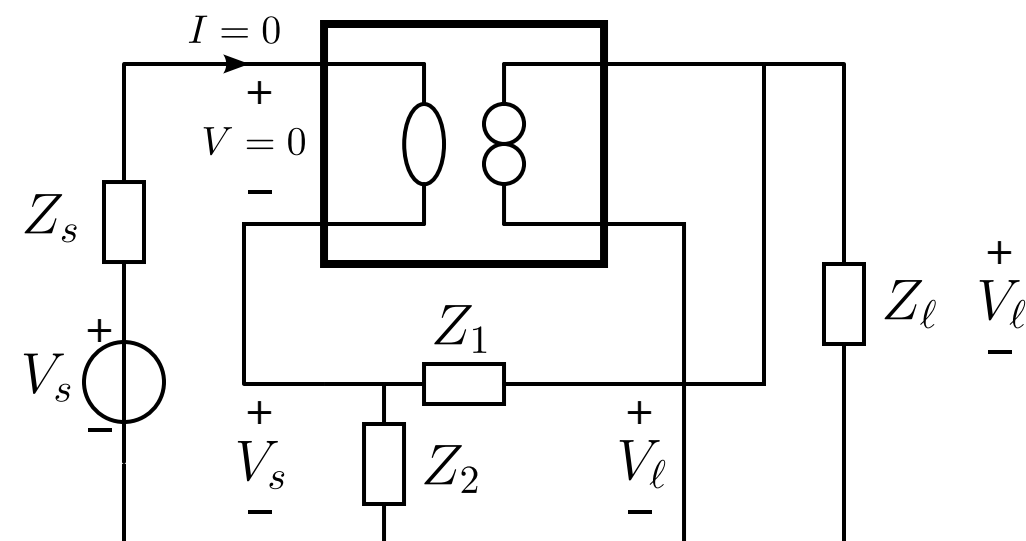
$$\frac{V_\ell}{V_s} = 1$$



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

$$\frac{V_\ell}{V_s} = \frac{Z_1 + Z_2}{Z_2}$$



## Passive feedback amplifier

- no port isolation
- noninverting
- gain larger than unity

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback

V

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I			

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance		

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback



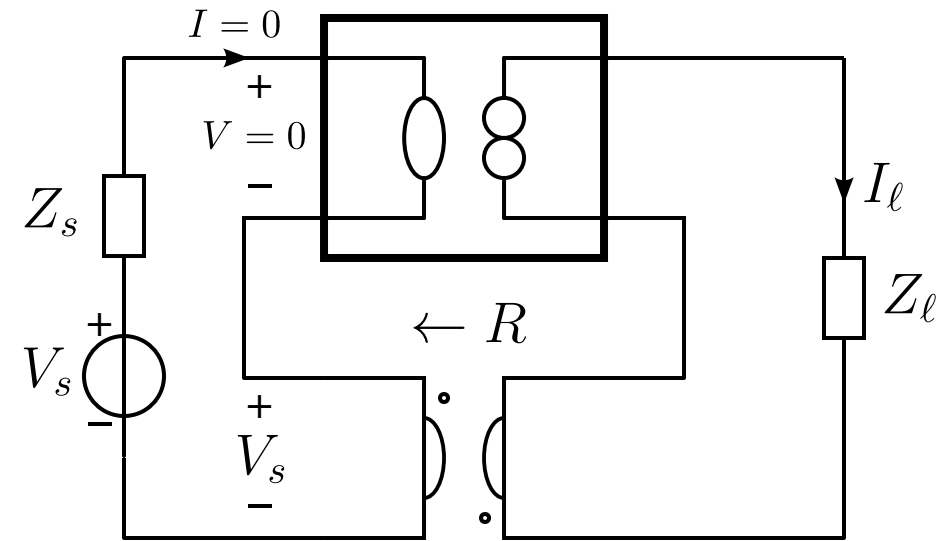
# Negative Feedback Transadmittance Configurations

# Negative Feedback Transadmittance Configurations

Nonenergetic feedback amplifier

# Negative Feedback Transadmittance Configurations

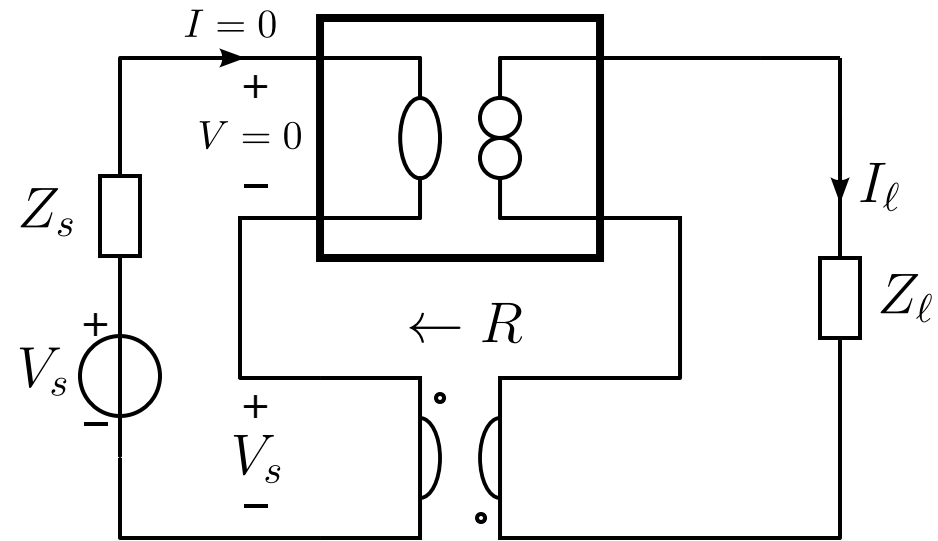
$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



## Nonenergetic feedback amplifier

# Negative Feedback Transadmittance Configurations

$$\frac{I_\ell}{V_s} = \frac{1}{R}$$

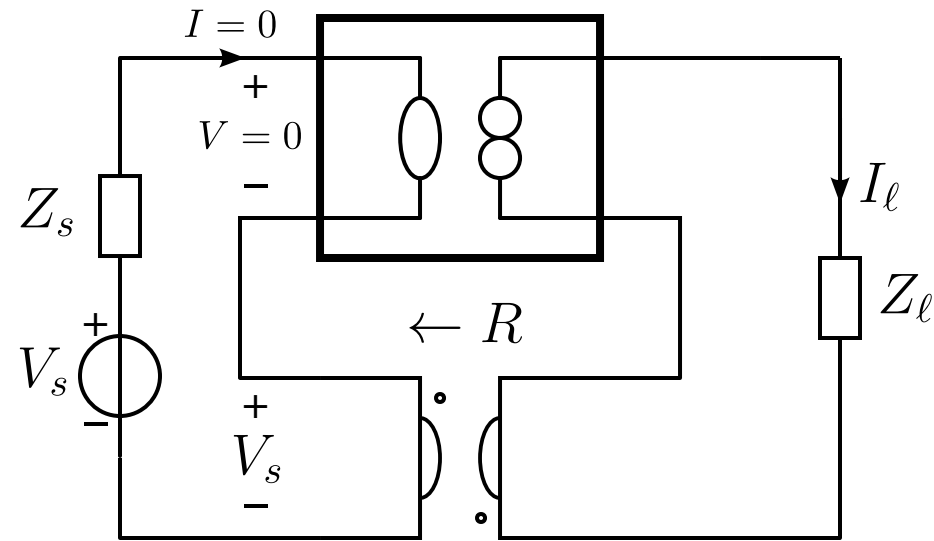


Nonenergetic feedback amplifier

- port isolation

# Negative Feedback Transadmittance Configurations

$$\frac{I_\ell}{V_s} = \frac{1}{R}$$

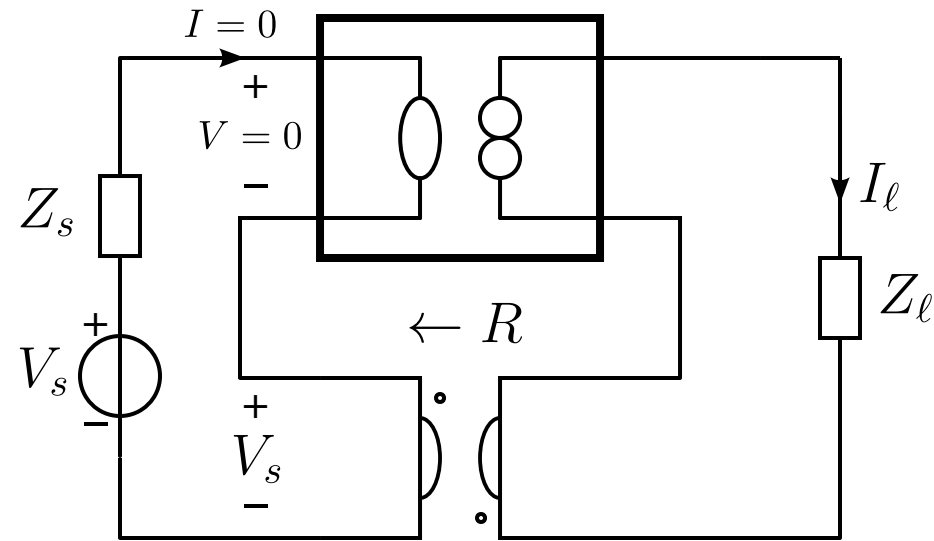


Nonenergetic feedback amplifier

- port isolation
- inverting or noninverting

# Negative Feedback Transadmittance Configurations

$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



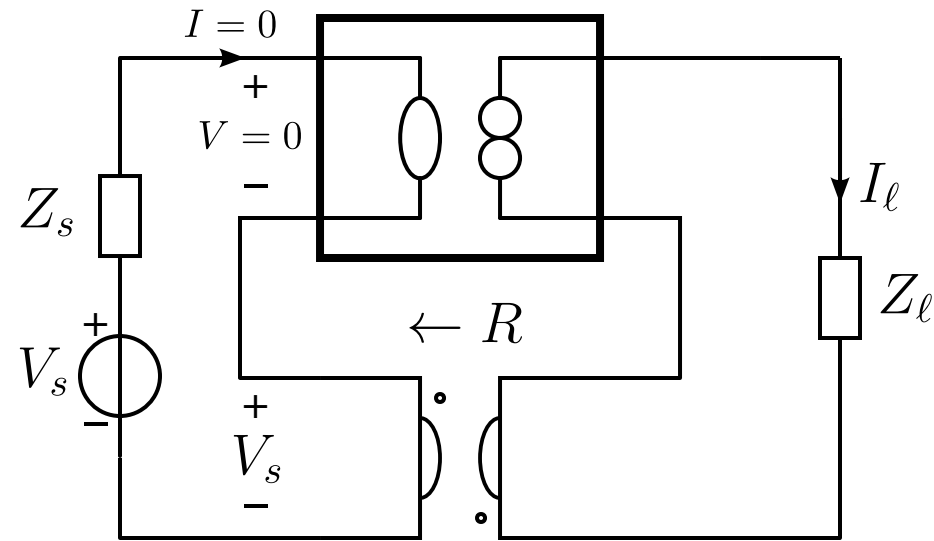
Nonenergic feedback amplifier

- port isolation
- inverting or noninverting

Passive feedback amplifier

# Negative Feedback Transadmittance Configurations

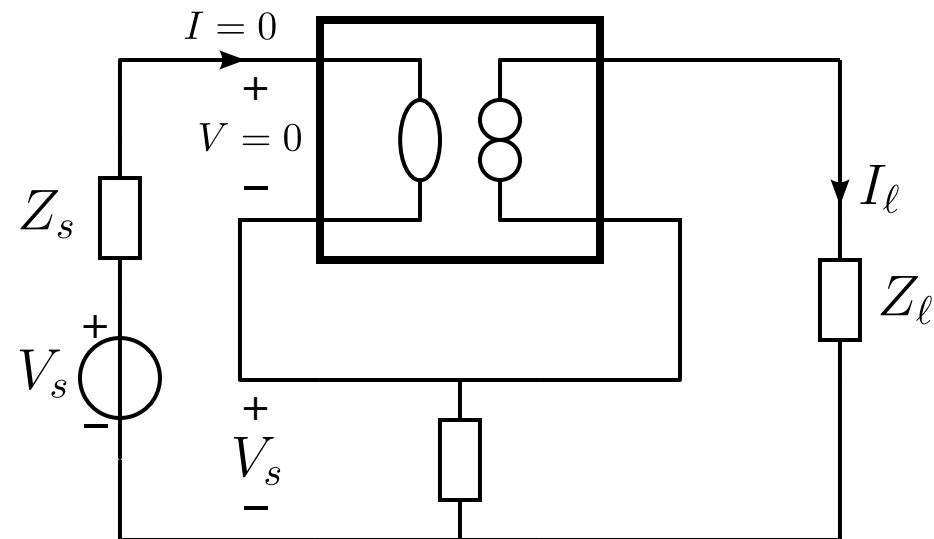
$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting

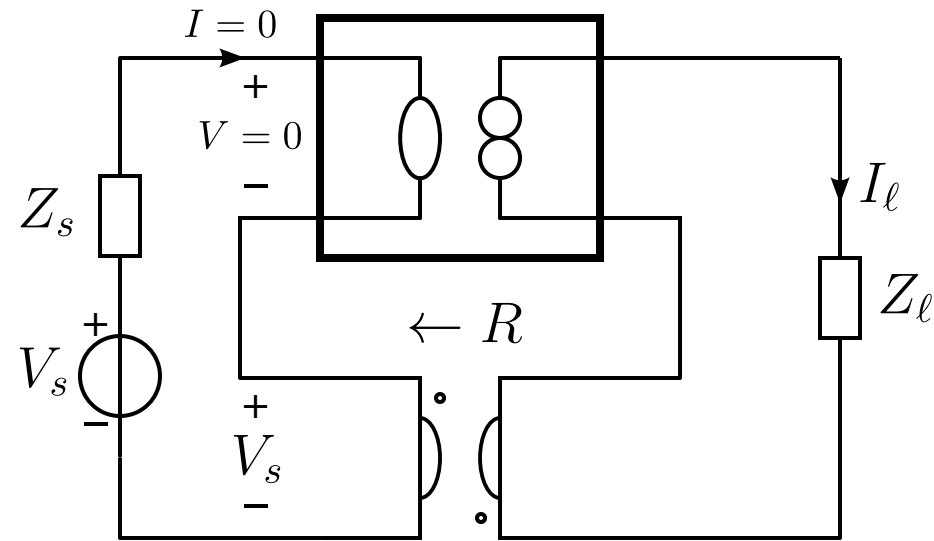
$$\frac{I_\ell}{V_s} = -\frac{1}{Z}$$



Passive feedback amplifier

# Negative Feedback Transadmittance Configurations

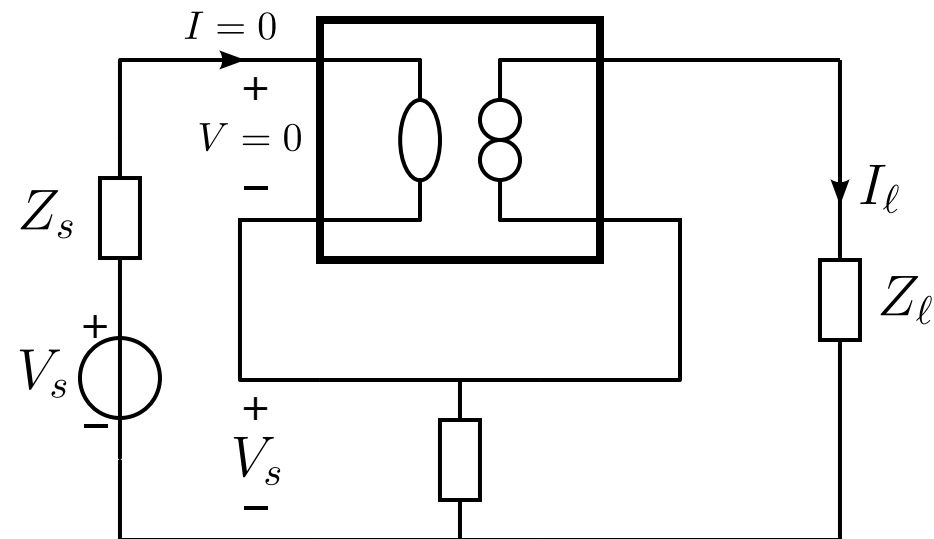
$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting

$$\frac{I_\ell}{V_s} = -\frac{1}{Z}$$



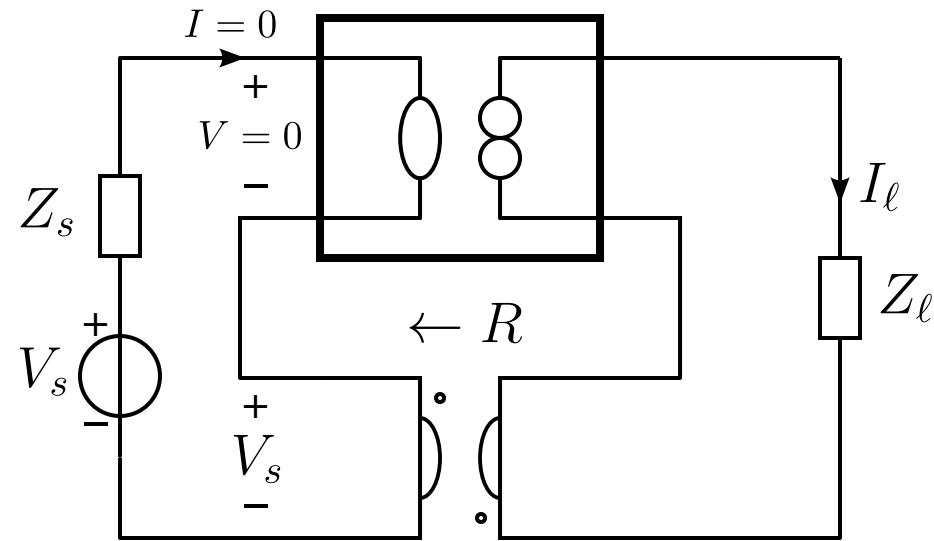
Passive feedback amplifier

- no port isolation



# Negative Feedback Transadmittance Configurations

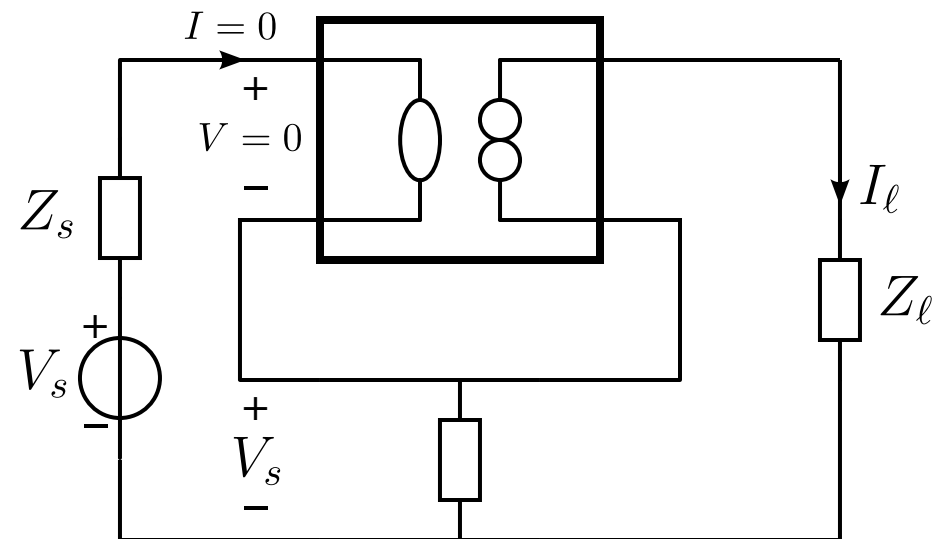
$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting

$$\frac{I_\ell}{V_s} = -\frac{1}{Z}$$

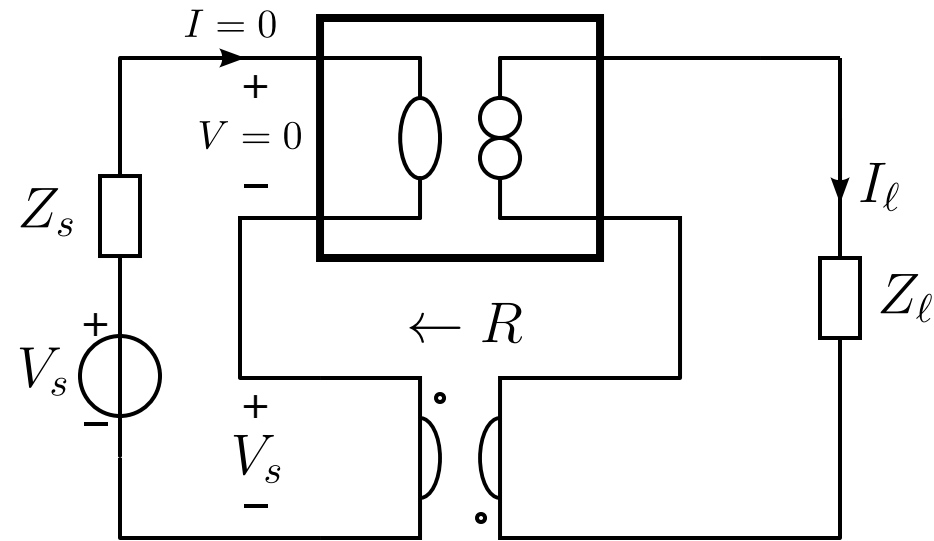


Passive feedback amplifier

- no port isolation
- inverting

# Negative Feedback Transadmittance Configurations

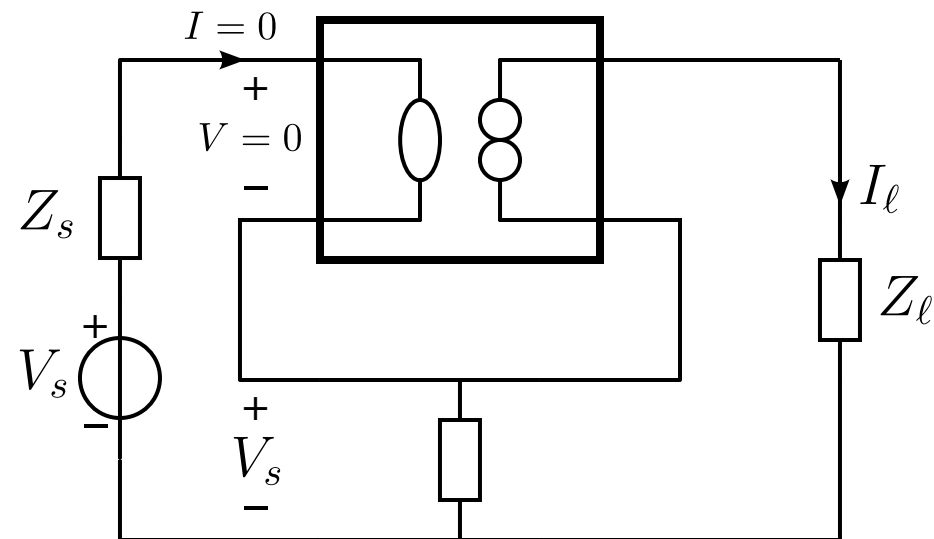
$$\frac{I_\ell}{V_s} = \frac{1}{R}$$



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting

$$\frac{I_\ell}{V_s} = -\frac{1}{Z}$$



Passive feedback amplifier

- no port isolation
- inverting

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback

I

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V			

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance		

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback

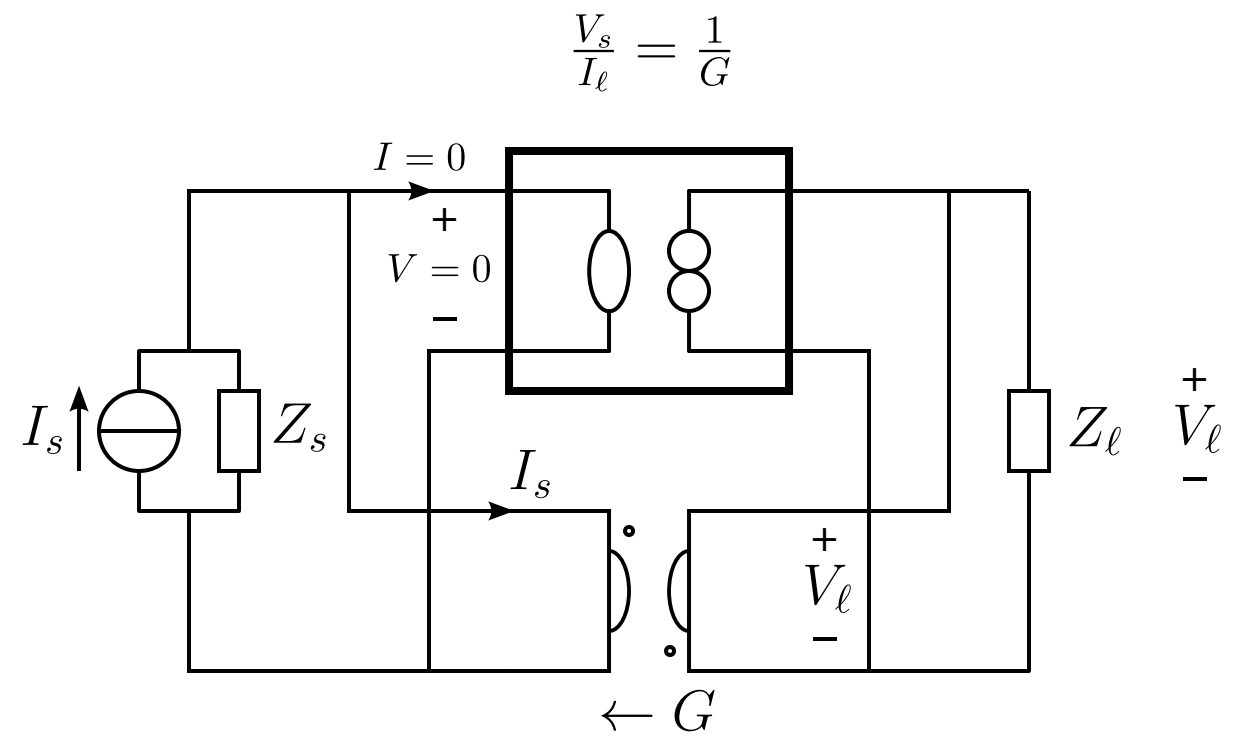


# Negative Feedback Transimpedance Configurations

# Negative Feedback Transimpedance Configurations

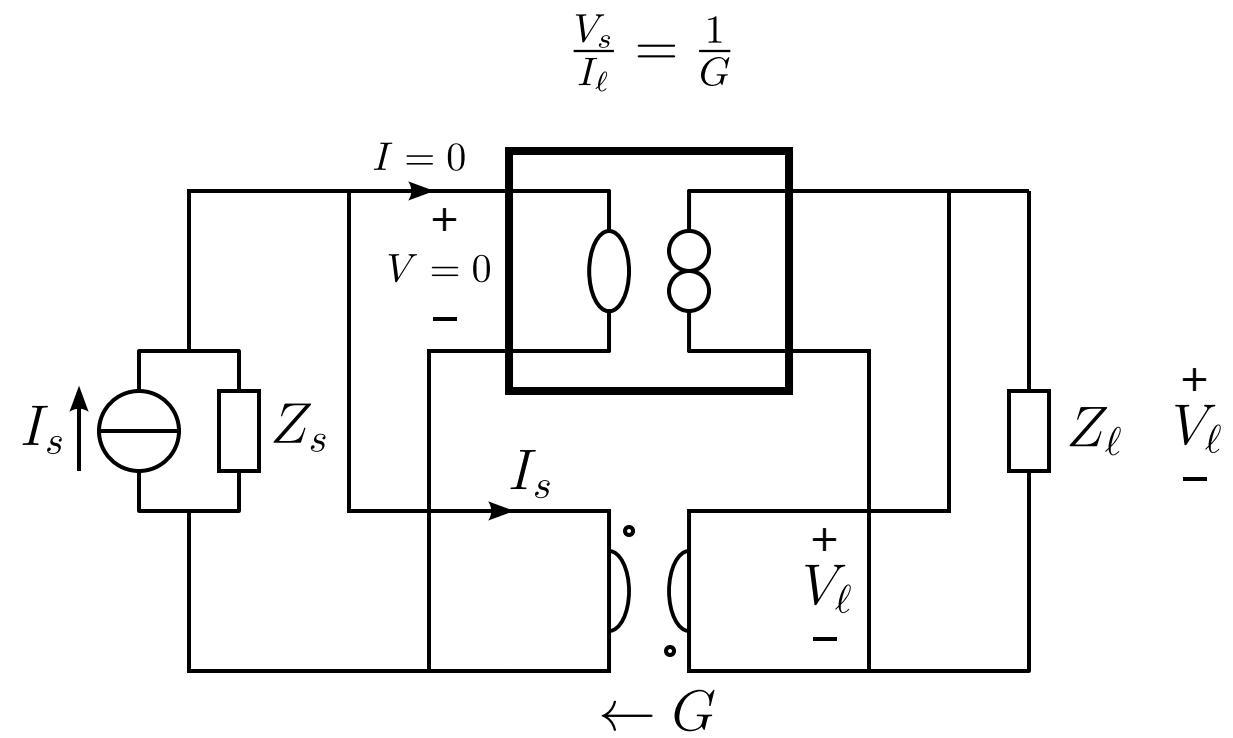
Nonenergetic feedback amplifier

# Negative Feedback Transimpedance Configurations



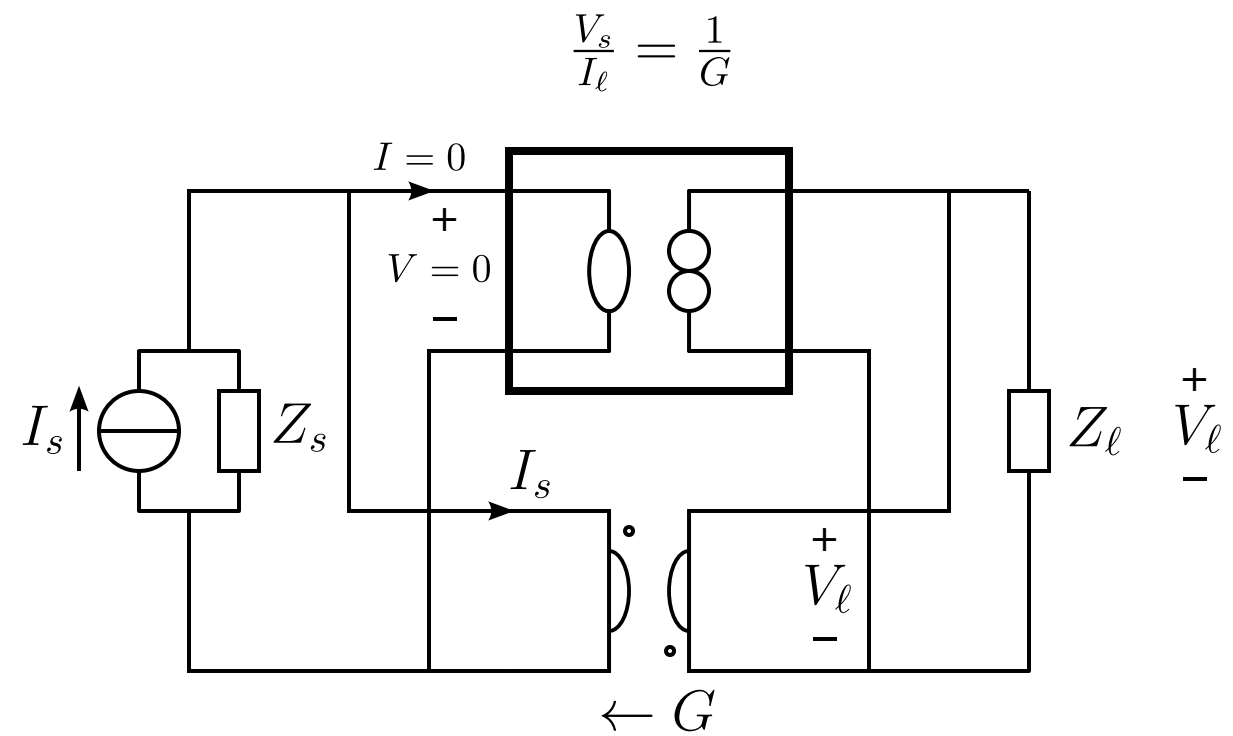
Nonenergic feedback amplifier

# Negative Feedback Transimpedance Configurations



Nonenergetic feedback amplifier  
- port isolation

# Negative Feedback Transimpedance Configurations

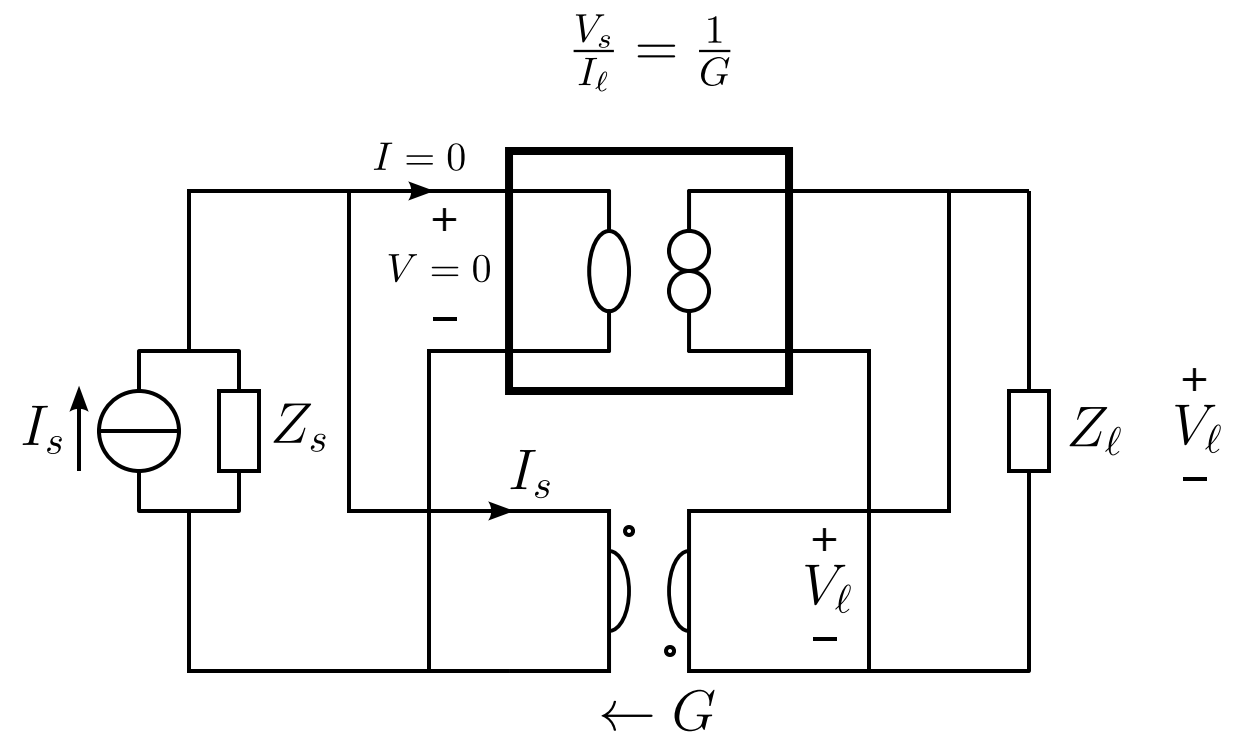


Nonenergetic feedback amplifier

- port isolation

- inverting or noninverting

# Negative Feedback Transimpedance Configurations

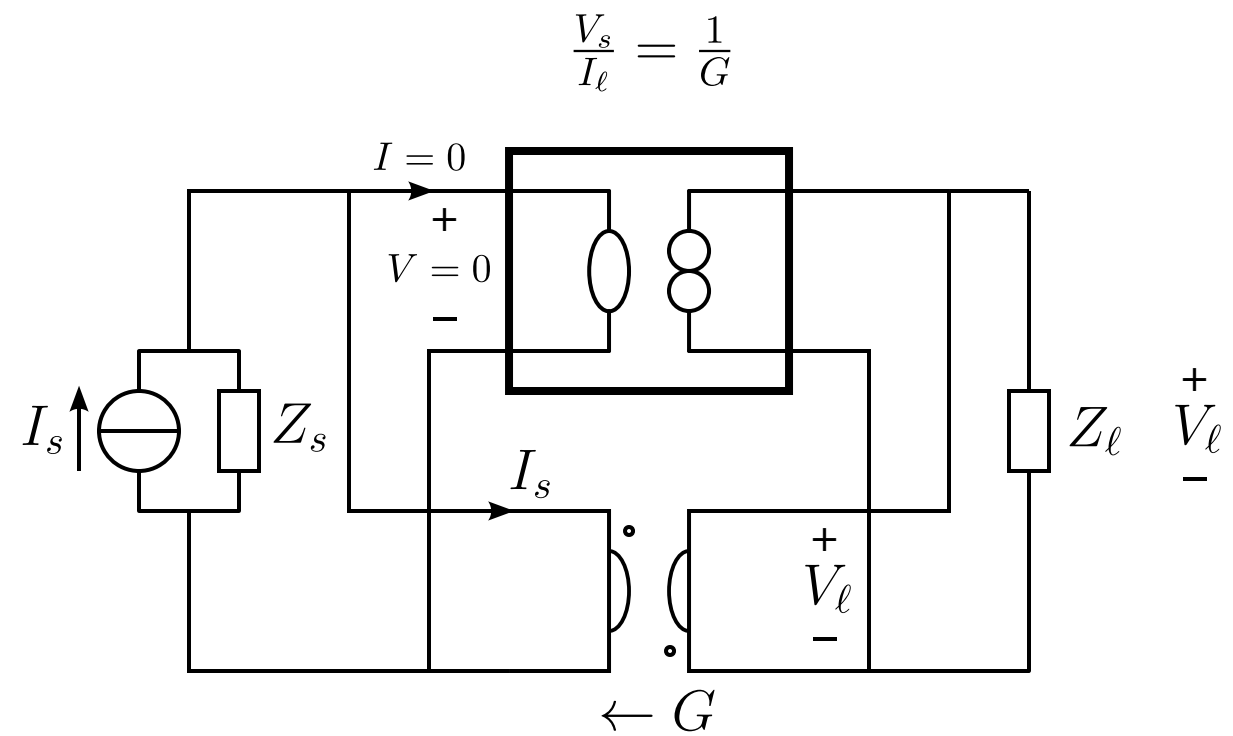


Nonenergetic feedback amplifier

- port isolation
- inverting or noninverting

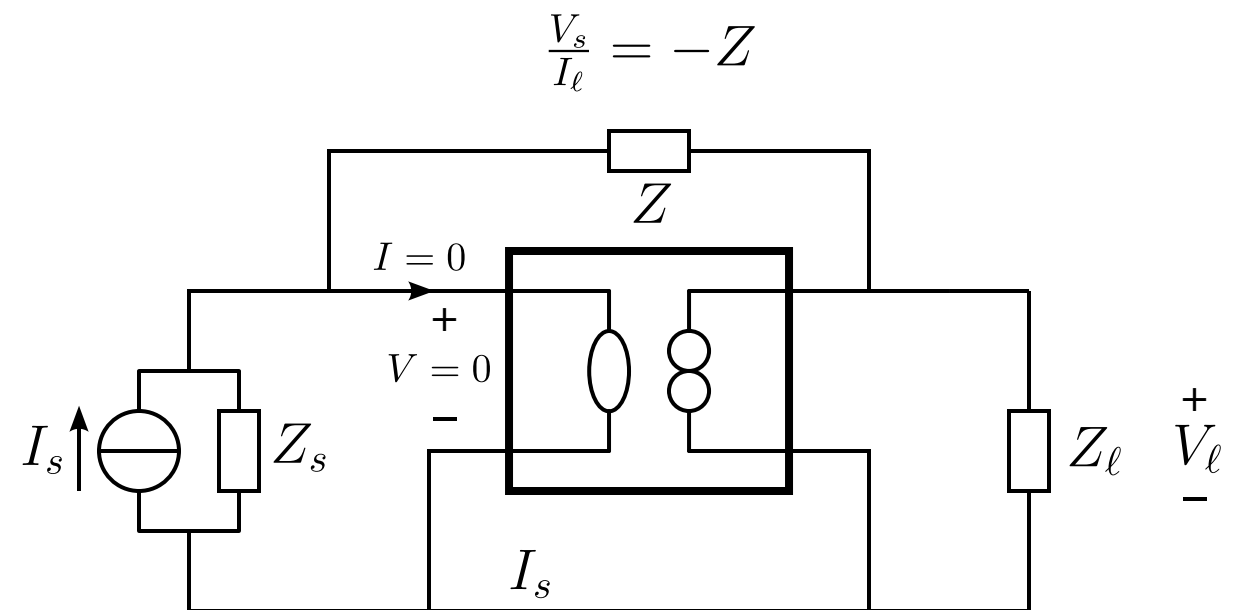
Passive feedback amplifier

# Negative Feedback Transimpedance Configurations



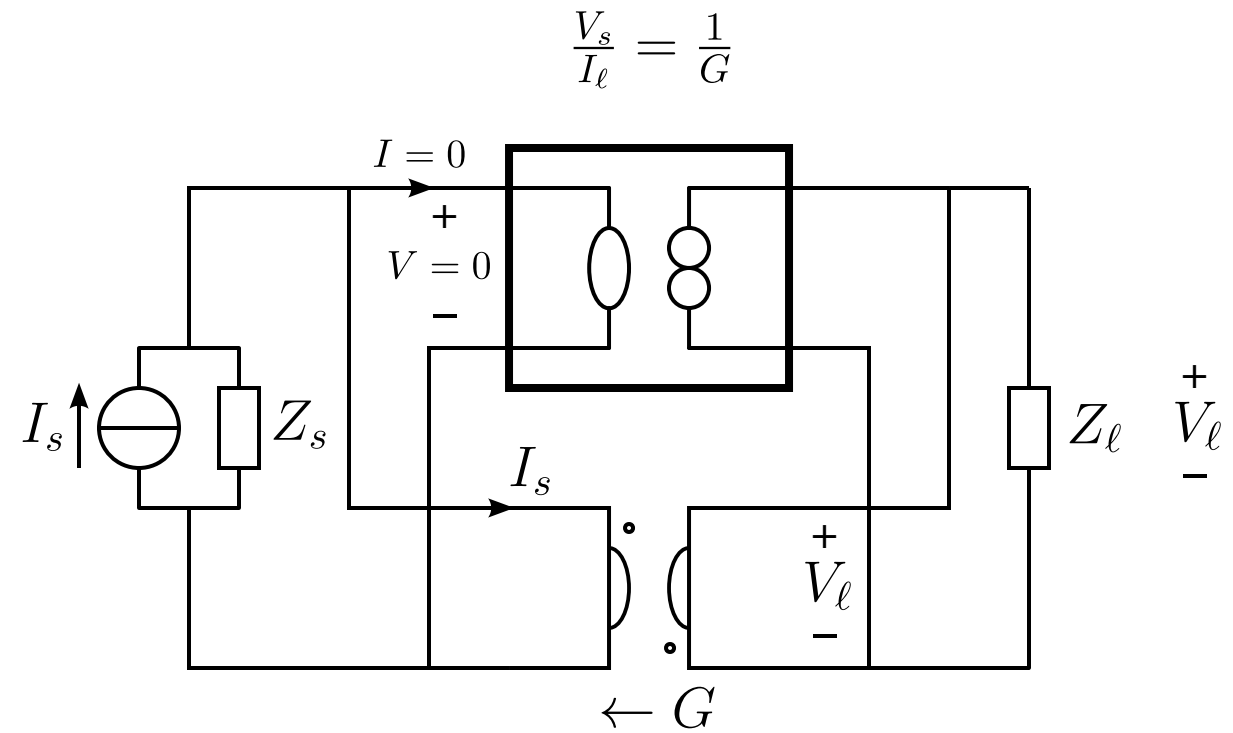
Nonenergic feedback amplifier

- port isolation
- inverting or noninverting



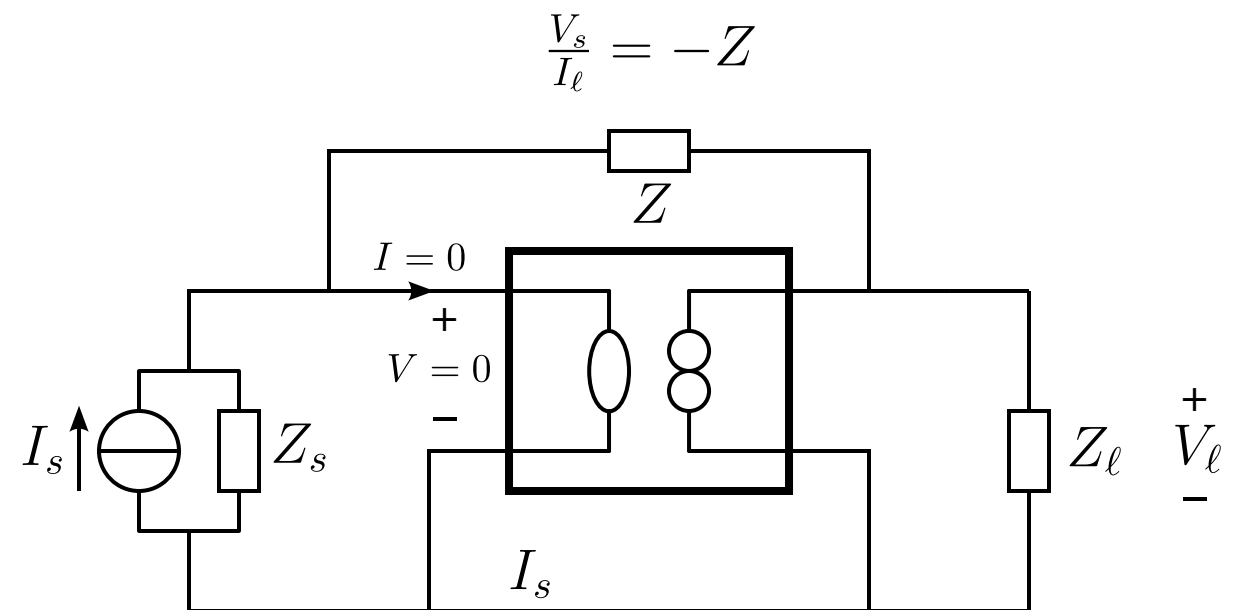
Passive feedback amplifier

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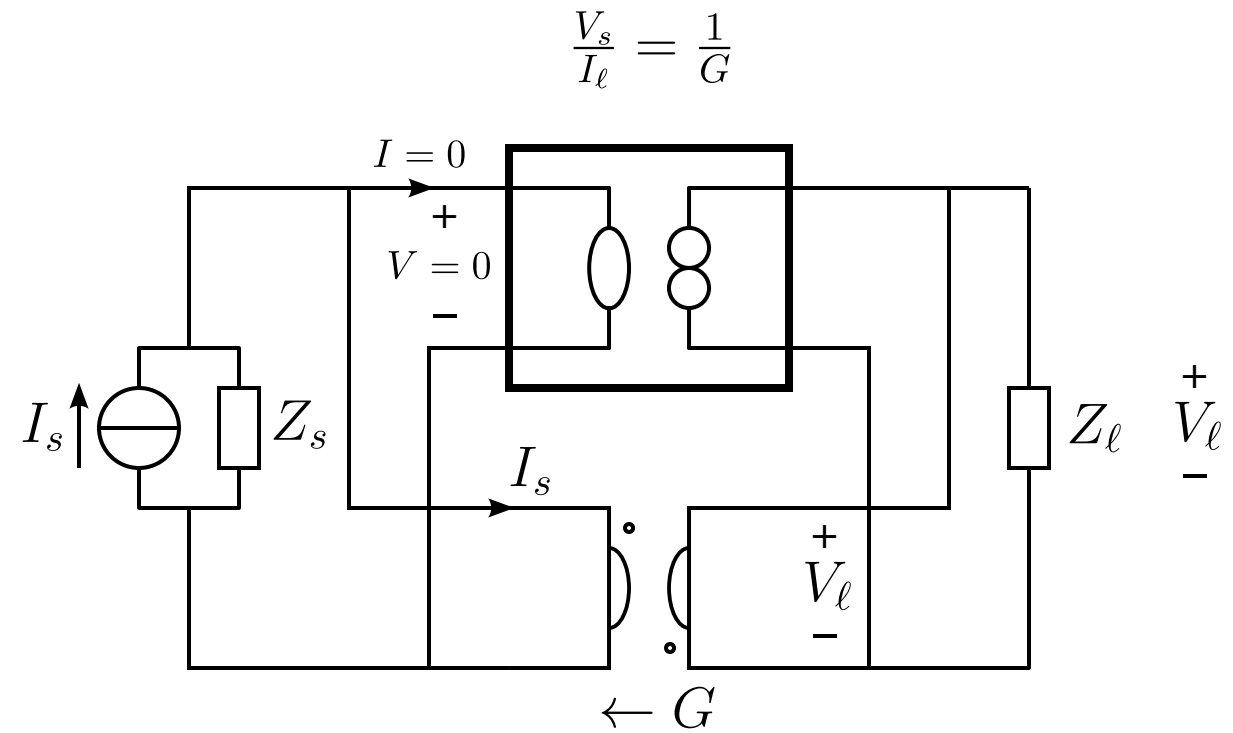


Passive feedback amplifier

- no port isolation

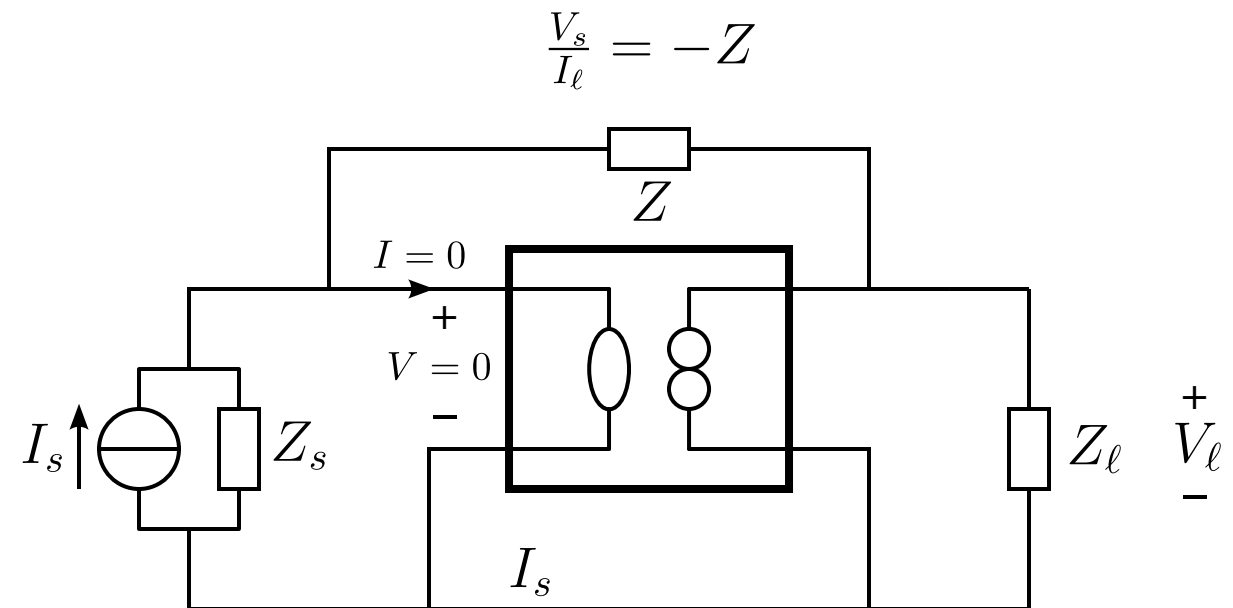


# Negative Feedback Transimpedance Configurations



## Nonenergic feedback amplifier

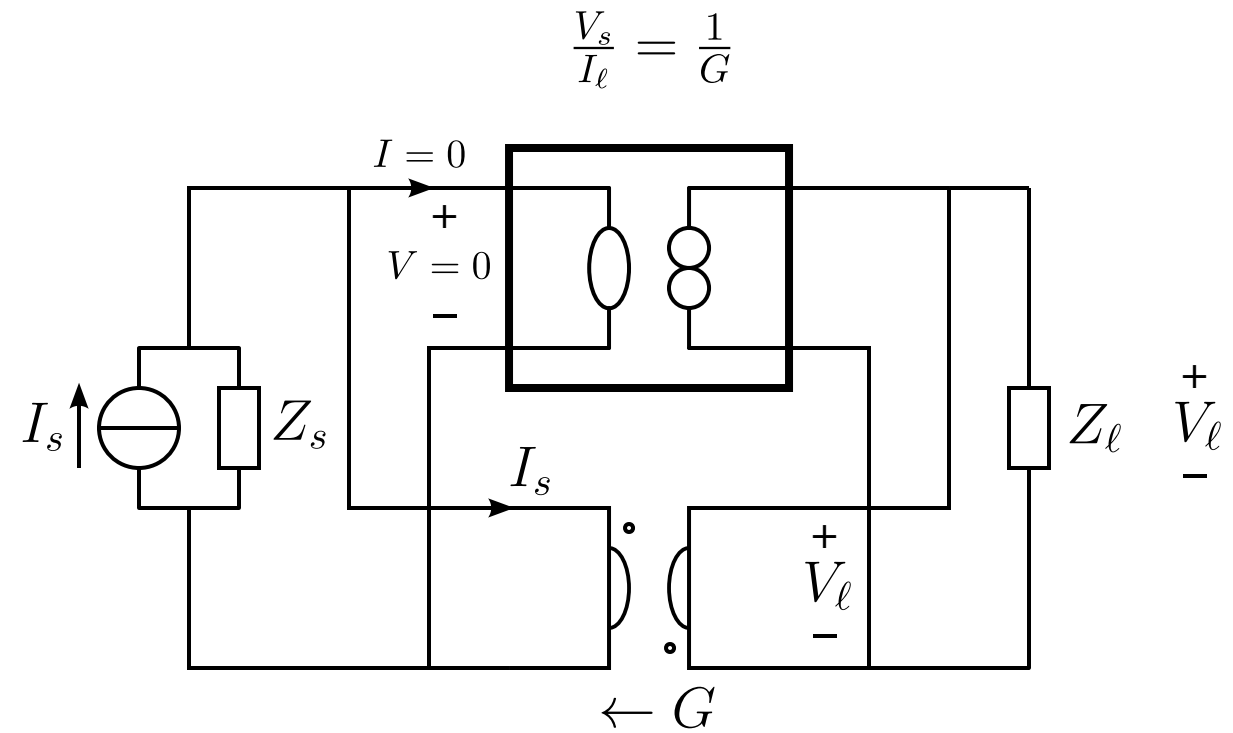
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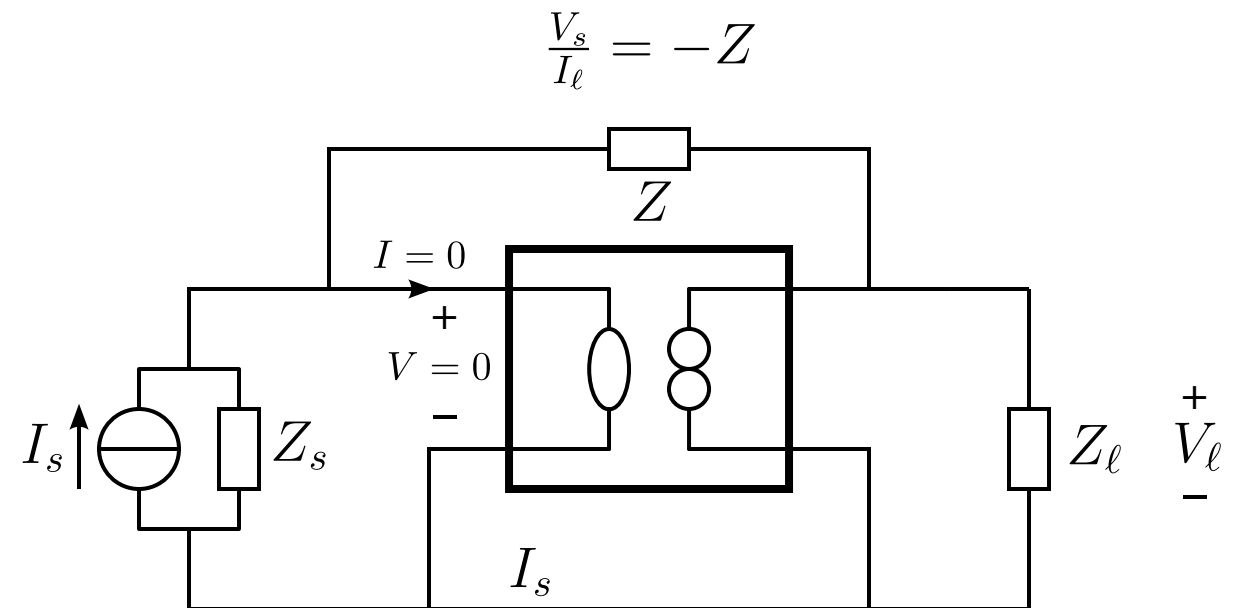
- no port isolation
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# Negative Feedback Transimpedance Configurations



## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting



## Passive feedback amplifier

- no port isolation
- inverting

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier	0, 0, 0, D	Output current sensing / series feedback Input current comparison / parallel feedback

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I			

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier		

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier	0, 0, 0, D	

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier	0, 0, 0, D	Output current sensing / series feedback

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier	0, 0, 0, D	Output current sensing / series feedback Input current comparison / parallel feedback

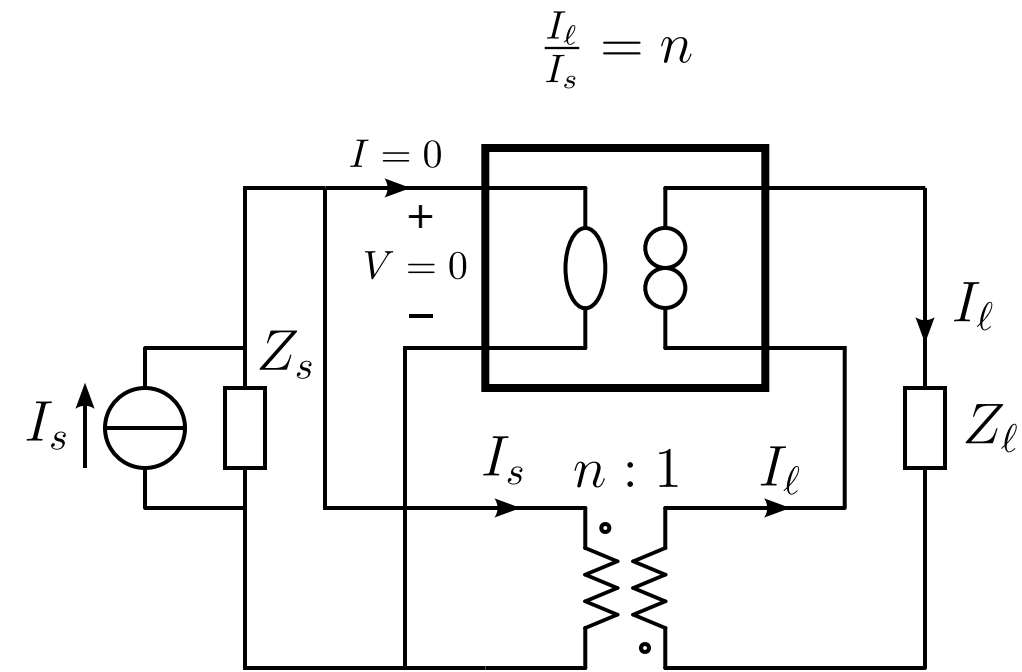


# Negative Feedback Current Amplifier Configurations

# Negative Feedback Current Amplifier Configurations

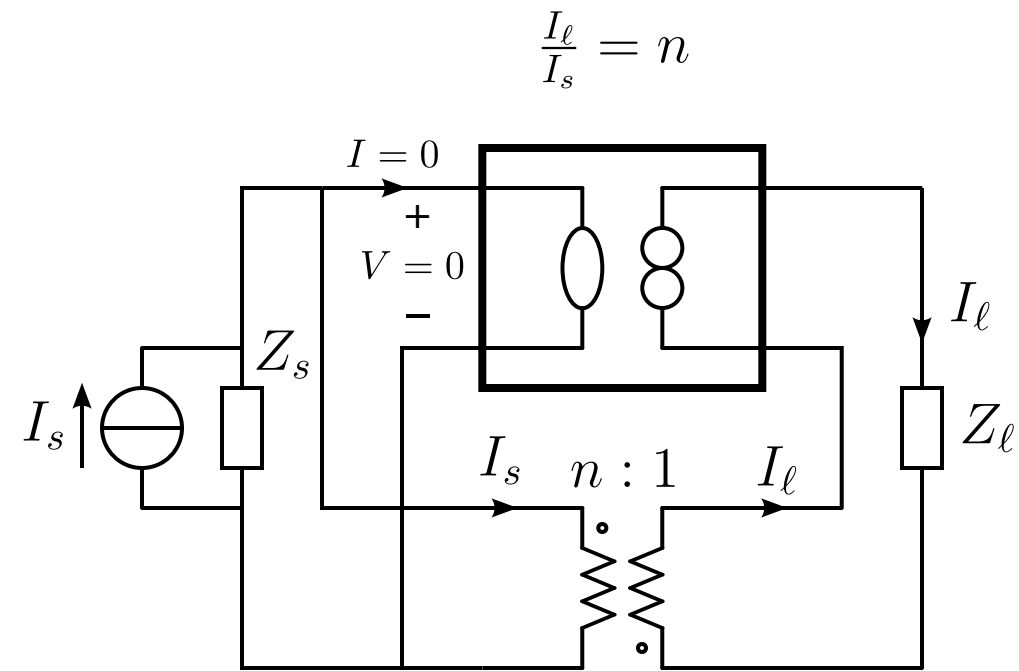
Nonenergetic feedback amplifier

# Negative Feedback Current Amplifier Configurations



Nonenergic feedback amplifier

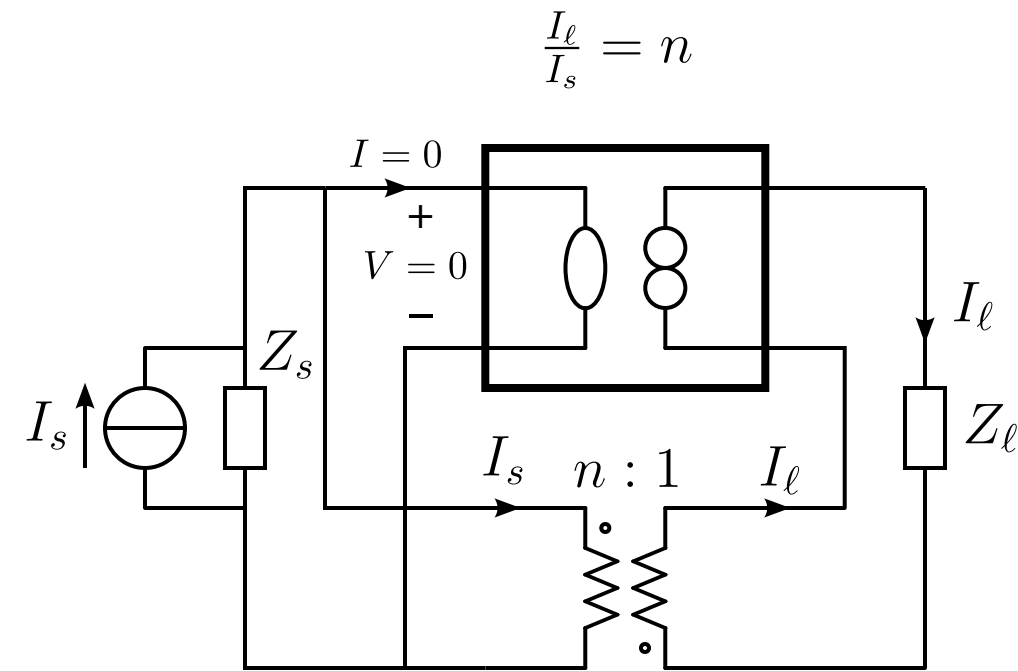
# Negative Feedback Current Amplifier Configurations



## Nonenergetic feedback amplifier

- port isolation

# Negative Feedback Current Amplifier Configurations

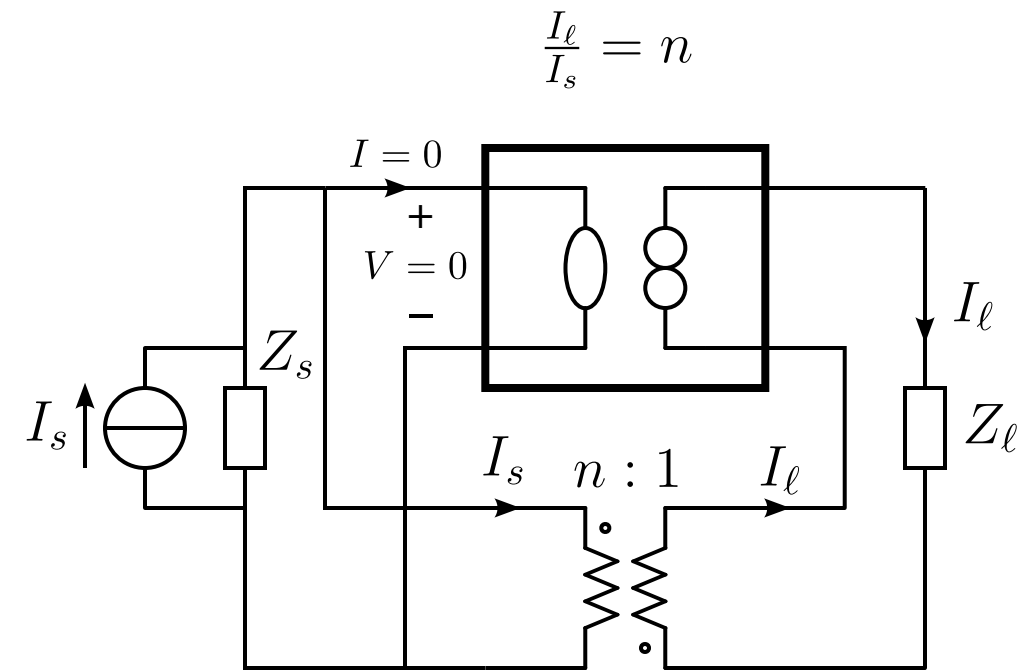


Nonenergetic feedback amplifier

- port isolation

- inverting or noninverting

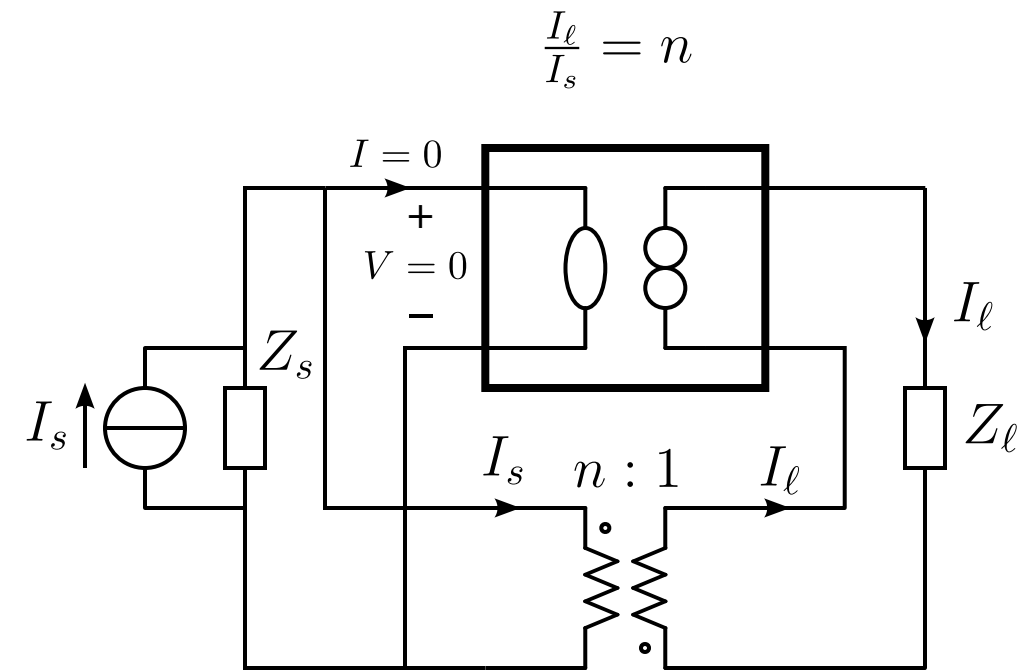
# Negative Feedback Current Amplifier Configurations



Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

# Negative Feedback Current Amplifier Configurations

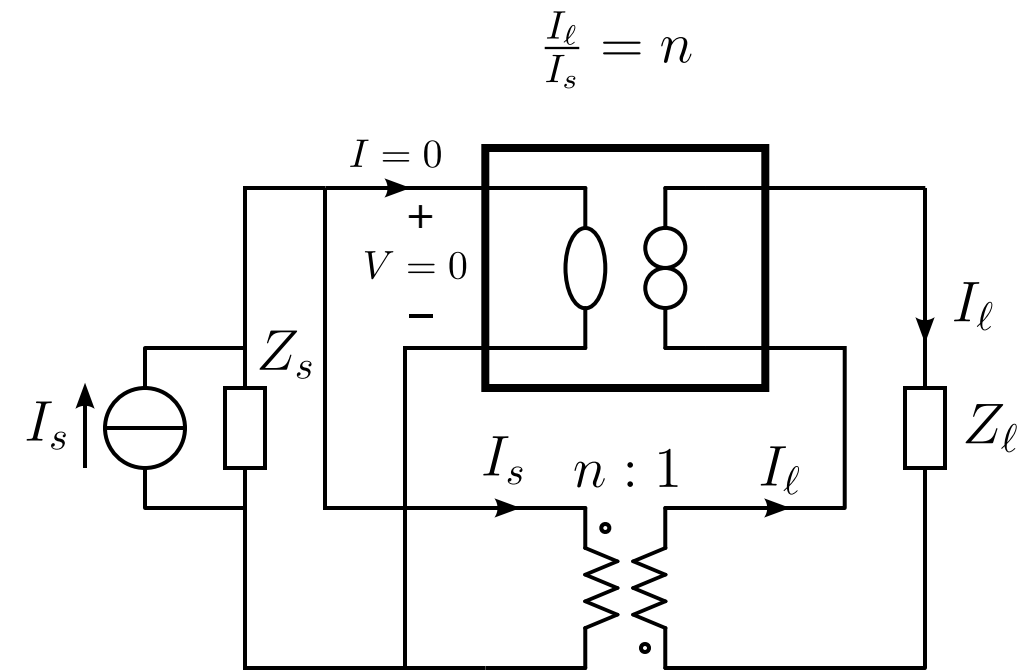


## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

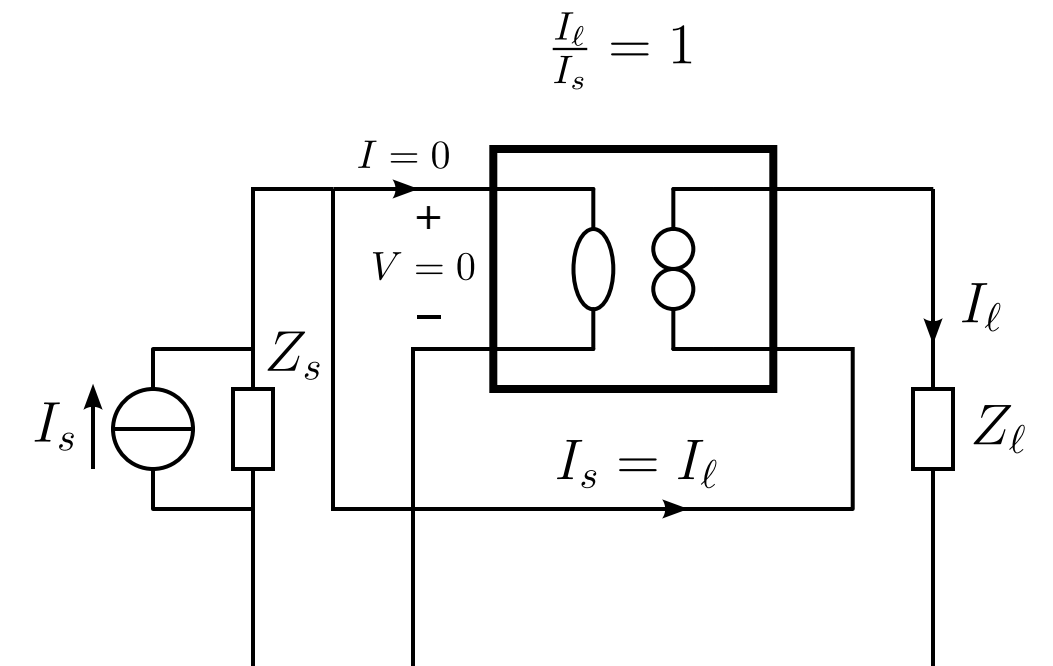
# Negative Feedback Current Amplifier Configurations



## Nonenergic feedback amplifier

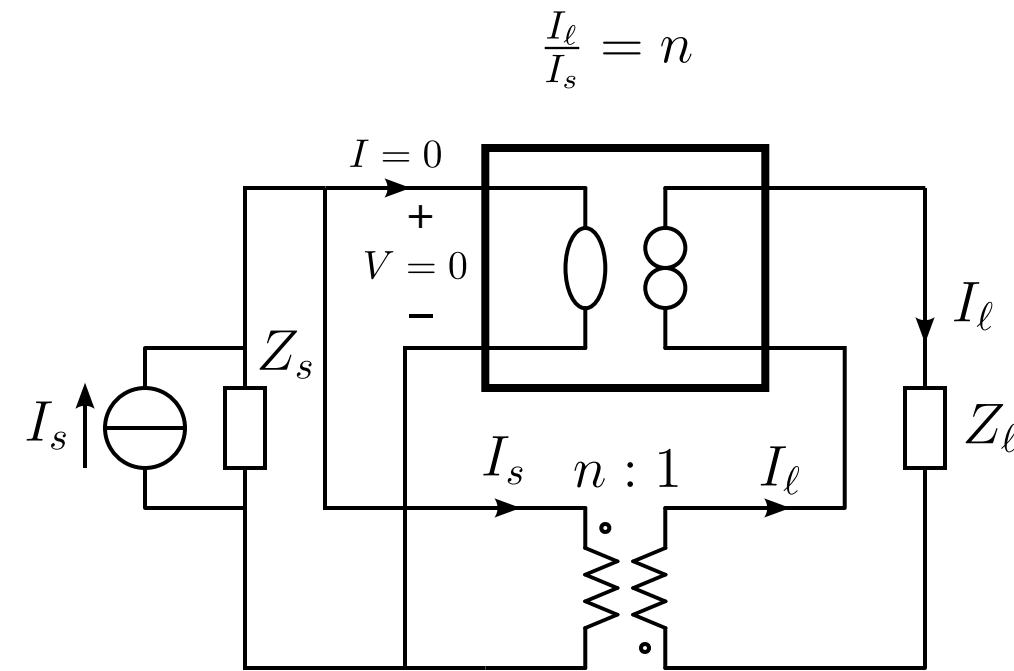
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower





# Negative Feedback Current Amplifier Configurations

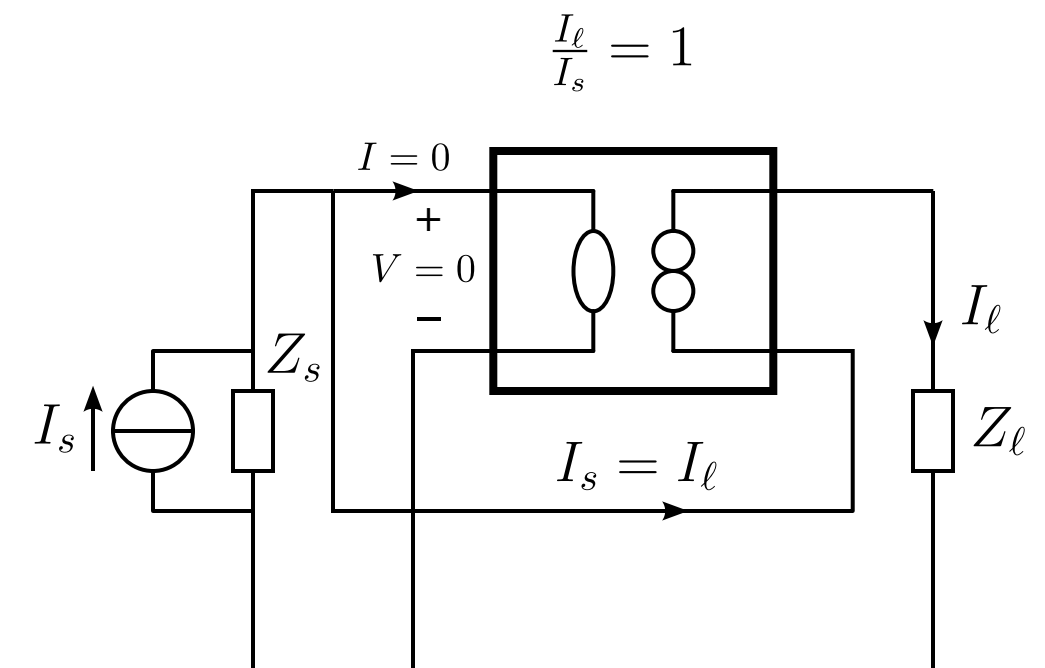


## Nonenergic feedback amplifier

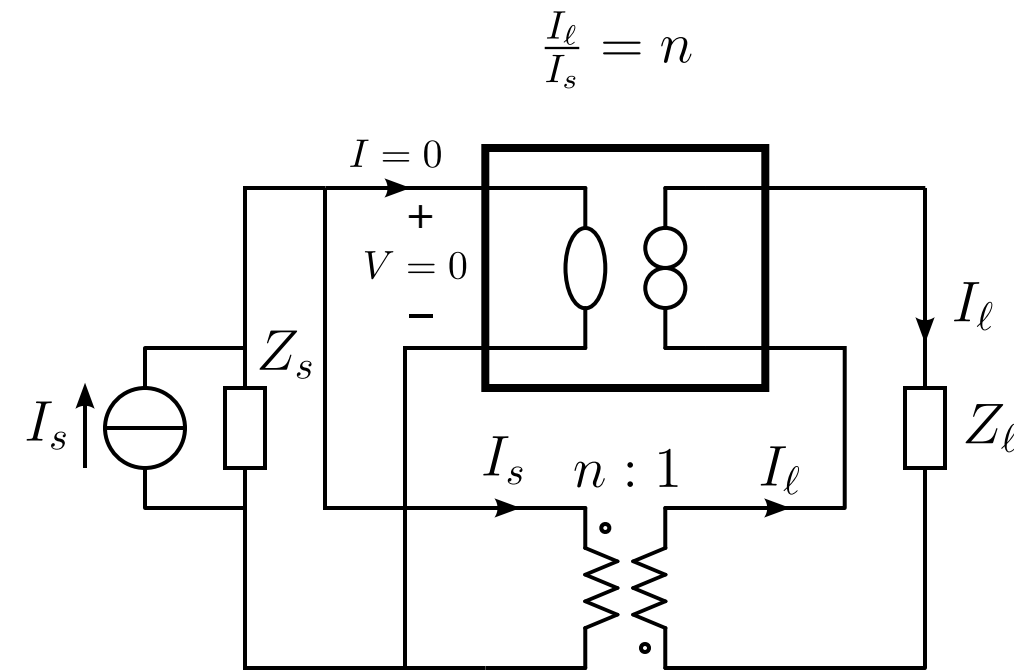
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

- no port isolation



# Negative Feedback Current Amplifier Configurations

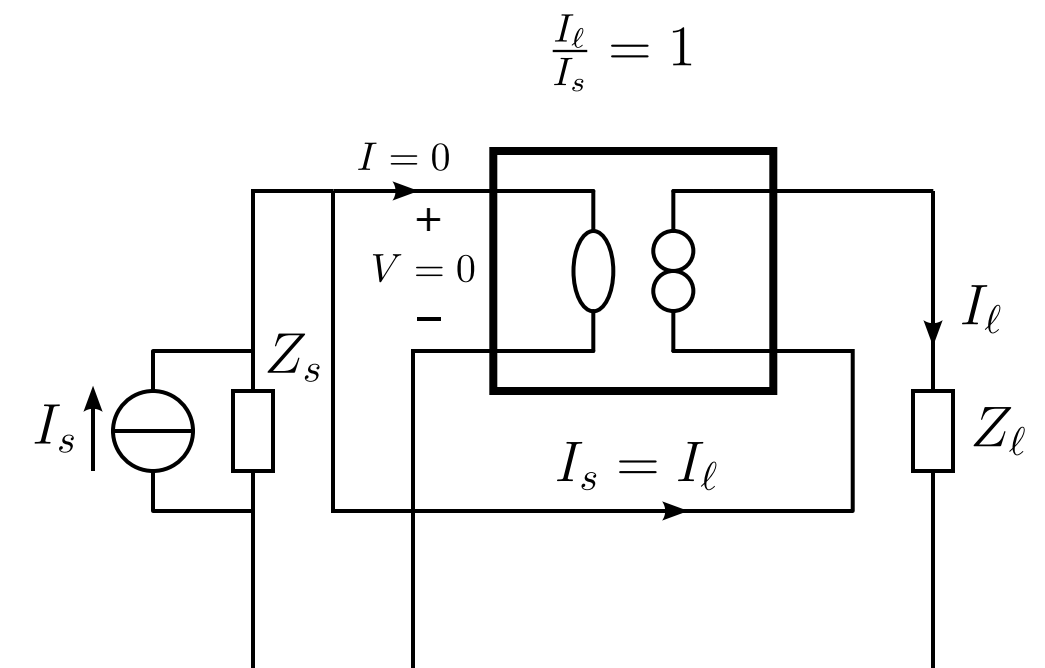


## Nonenergic feedback amplifier

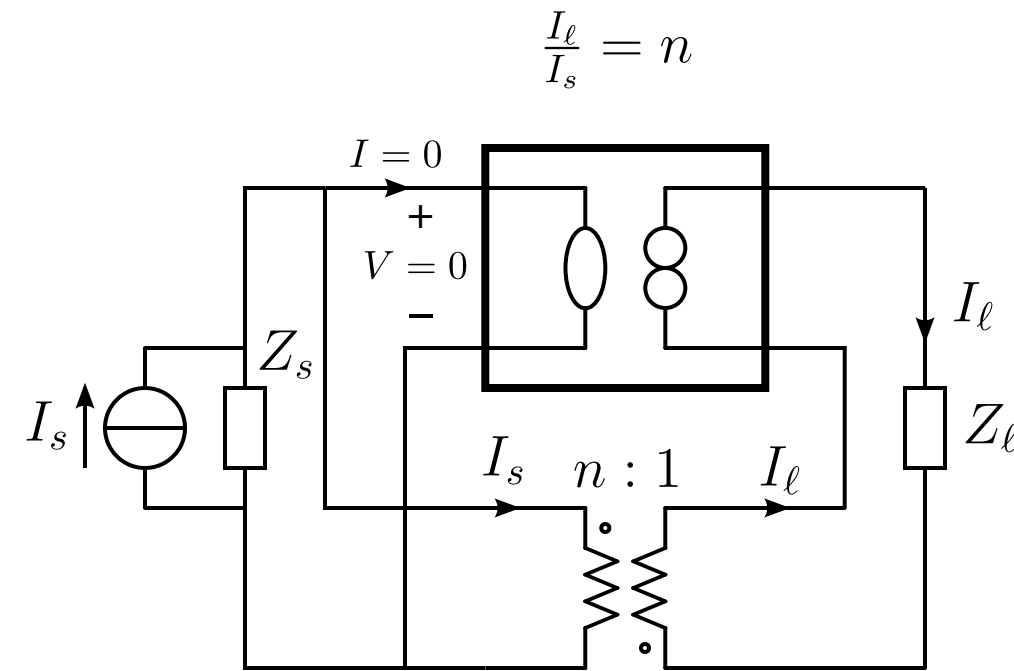
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

- no port isolation
- **noninverting**



# Negative Feedback Current Amplifier Configurations

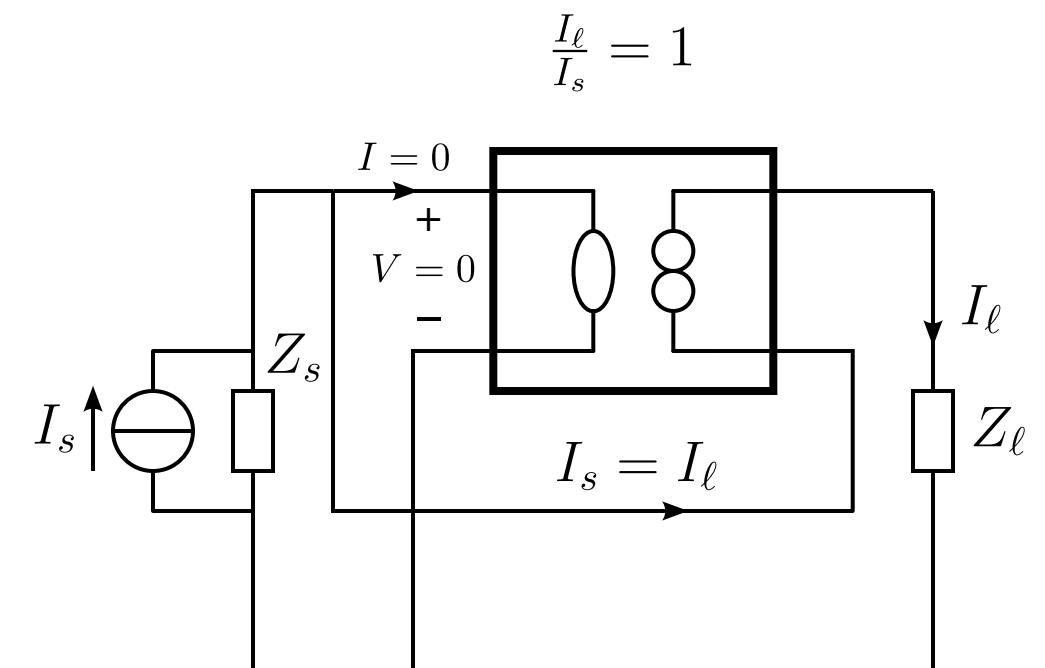


## Nonenergic feedback amplifier

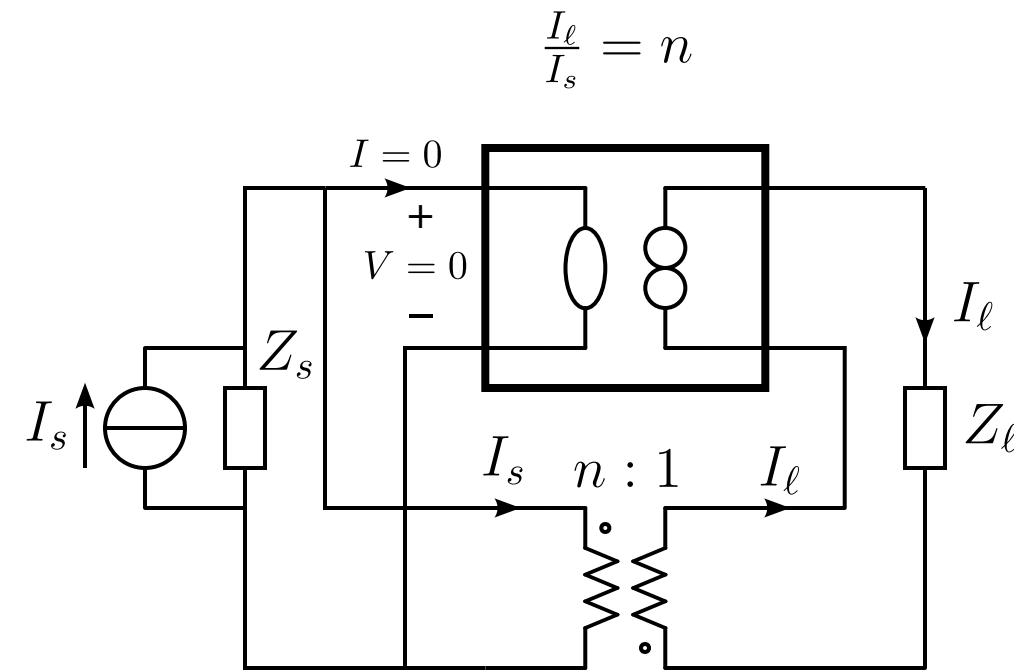
- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity



# Negative Feedback Current Amplifier Configurations

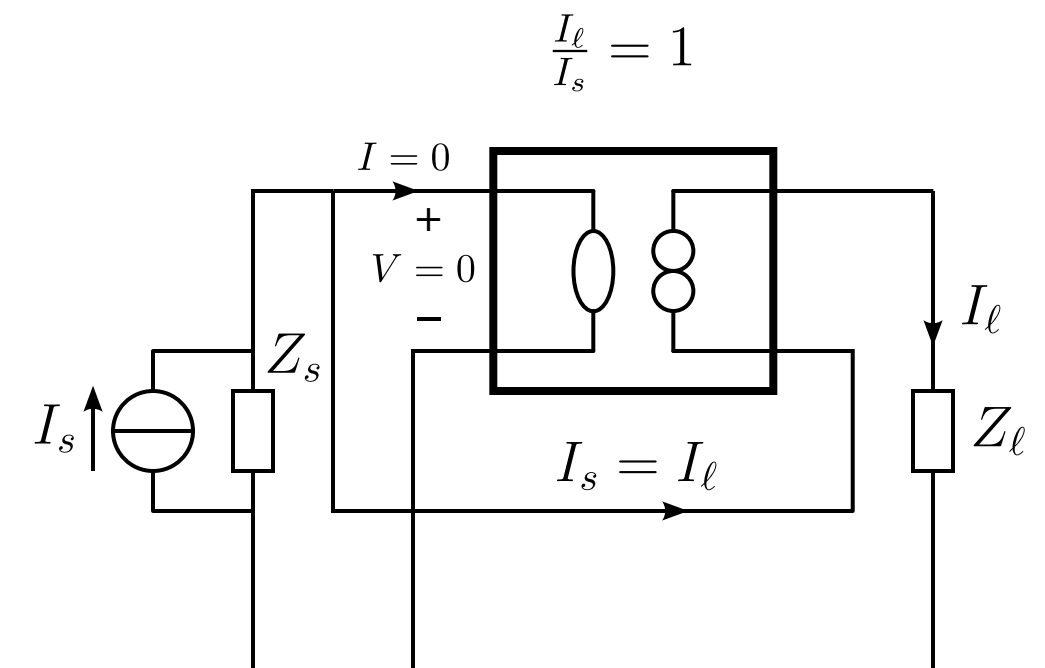


## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

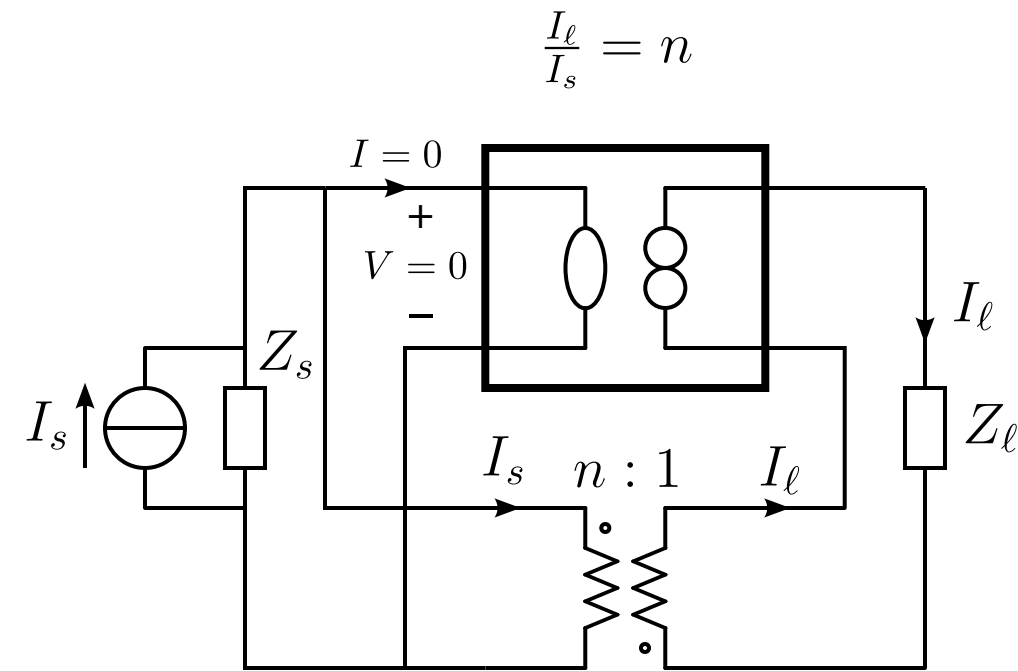
## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity



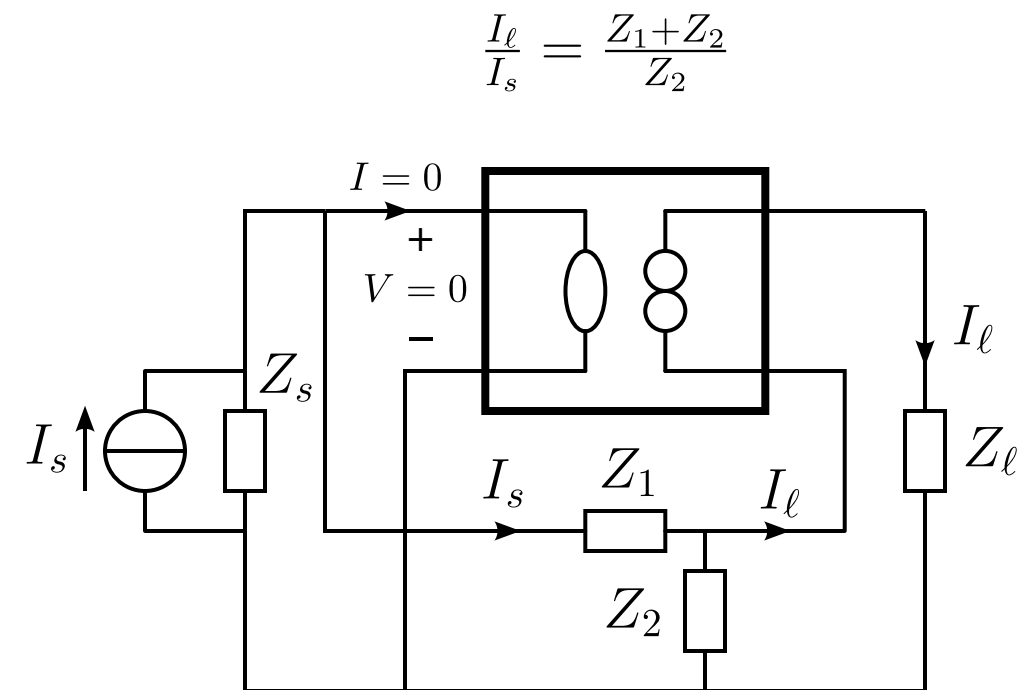
## Passive feedback amplifier

# Negative Feedback Current Amplifier Configurations



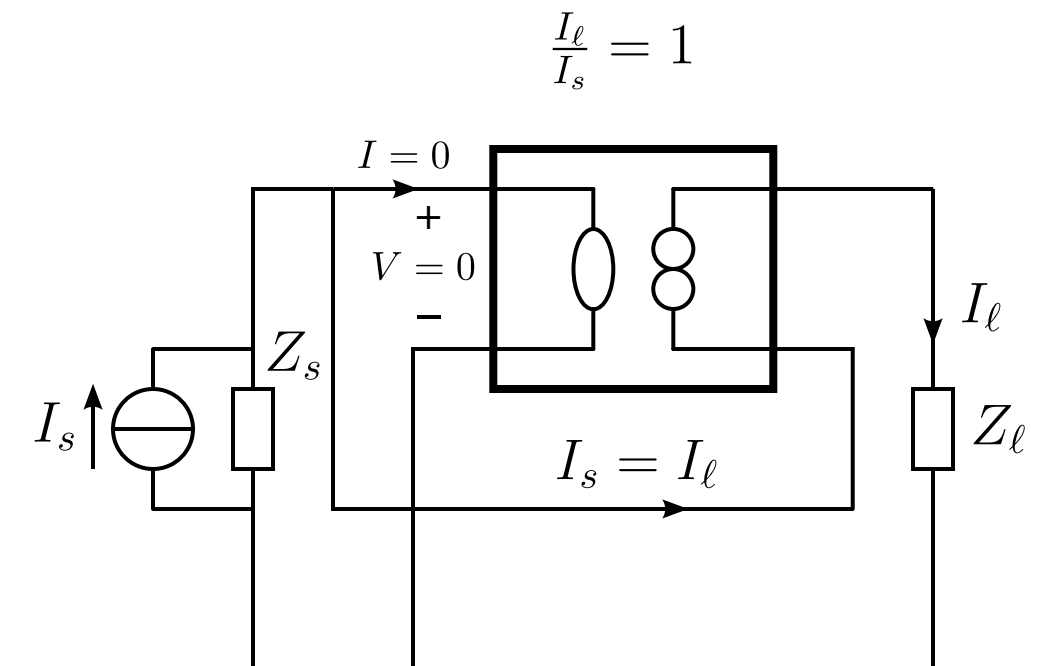
## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity



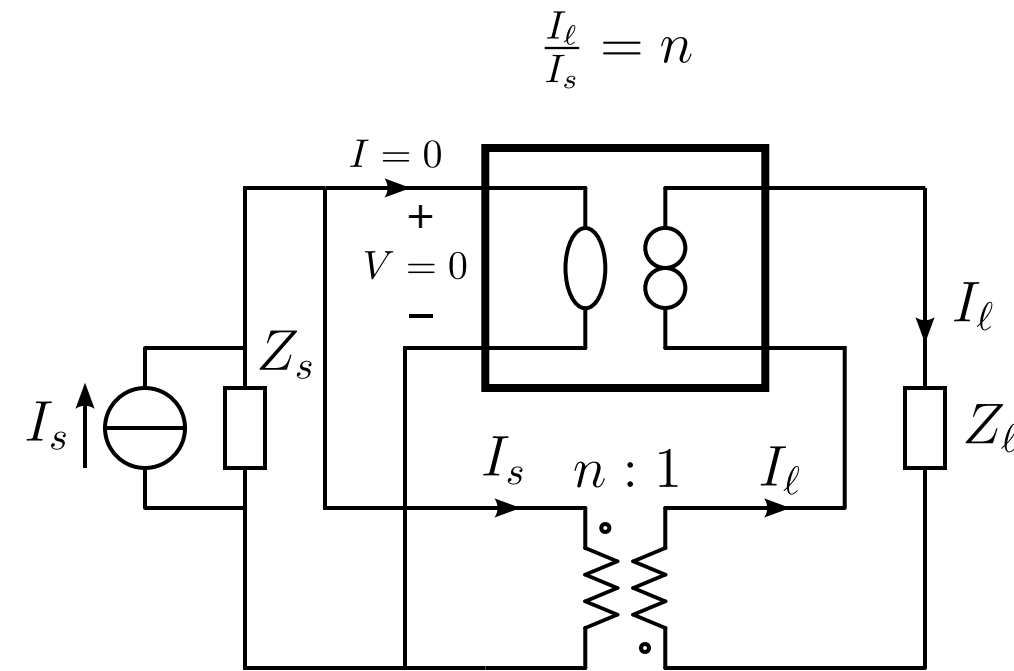
## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity



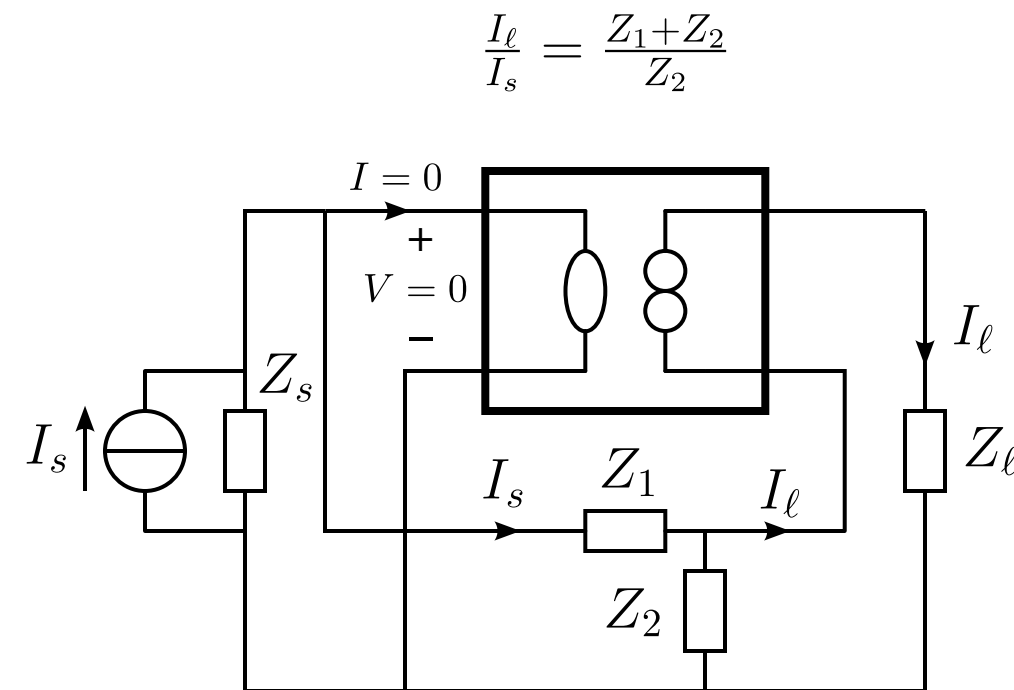
## Passive feedback amplifier

# Negative Feedback Current Amplifier Configurations



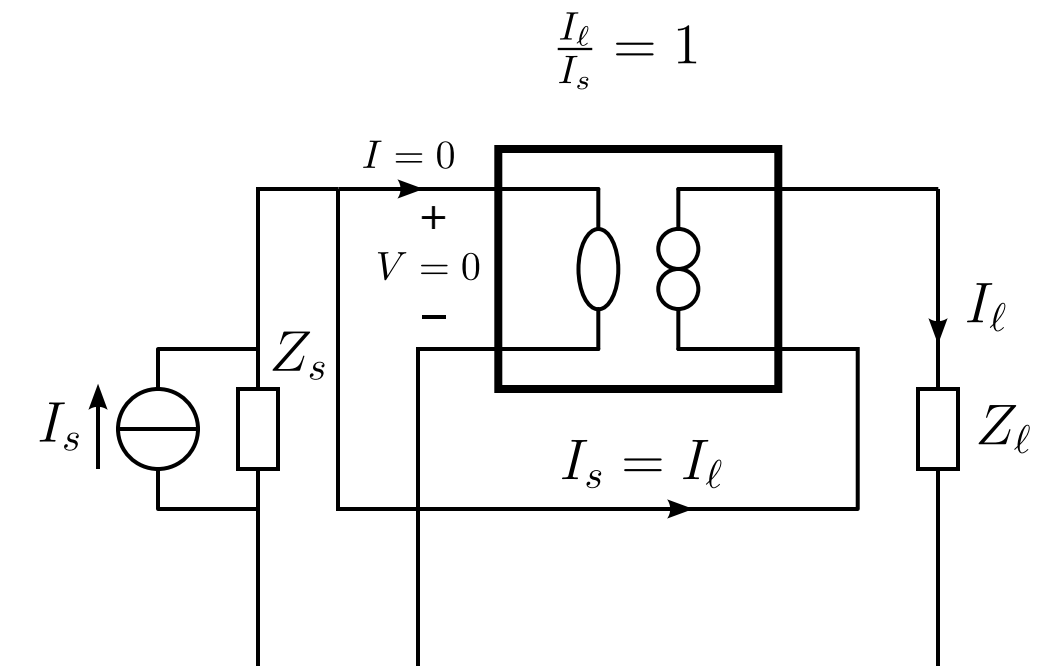
## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

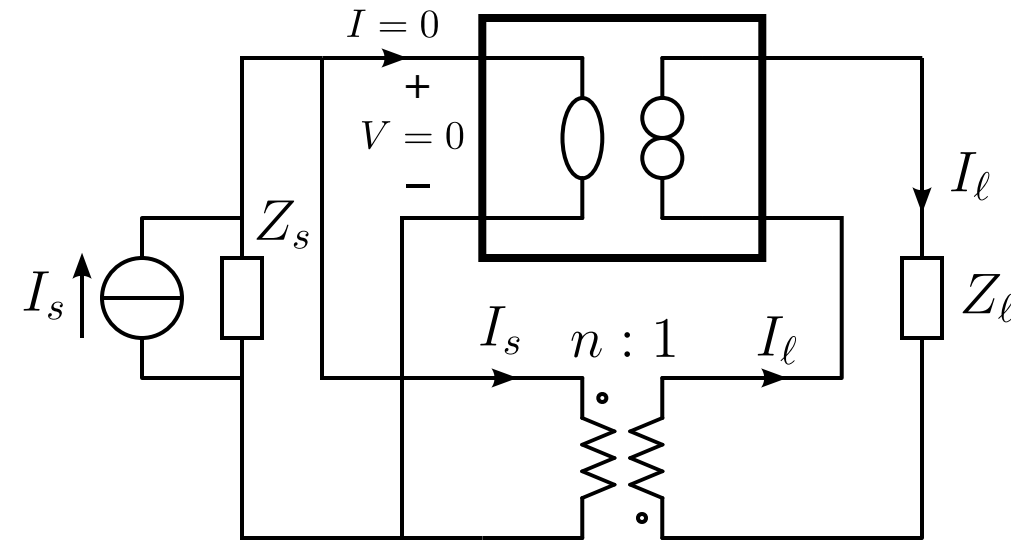


## Passive feedback amplifier

- no port isolation

# Negative Feedback Current Amplifier Configurations

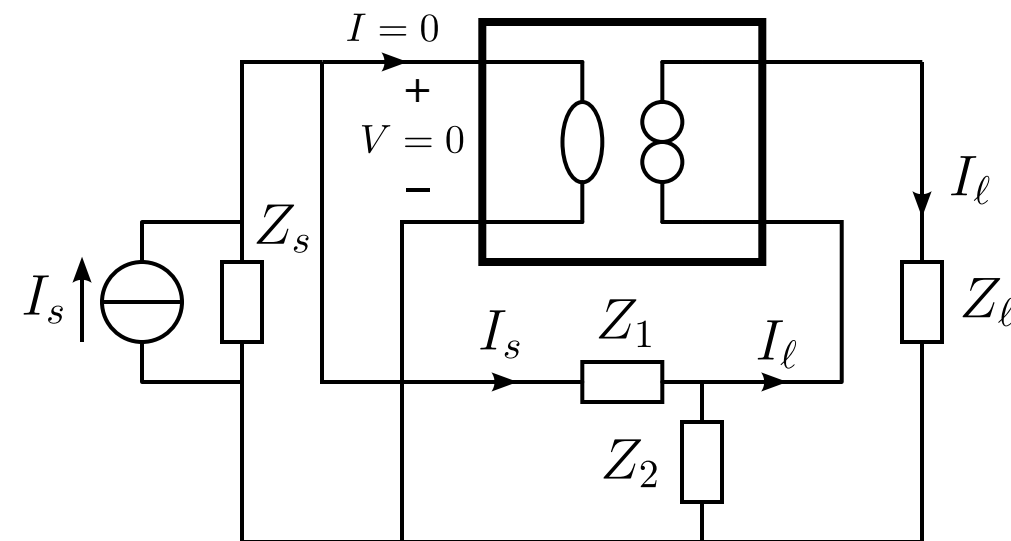
$$\frac{I_\ell}{I_s} = n$$



## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity

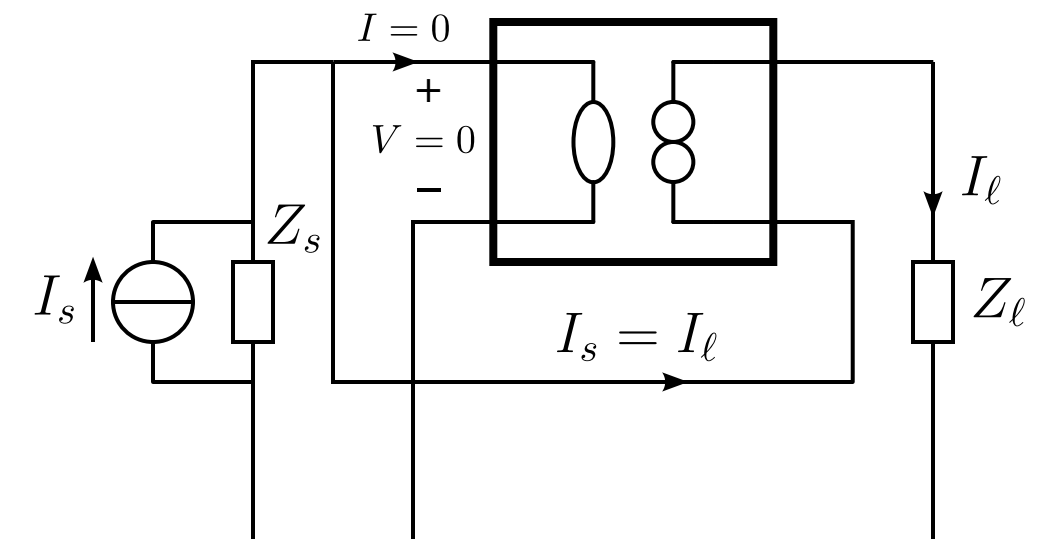
$$\frac{I_\ell}{I_s} = \frac{Z_1 + Z_2}{Z_2}$$



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

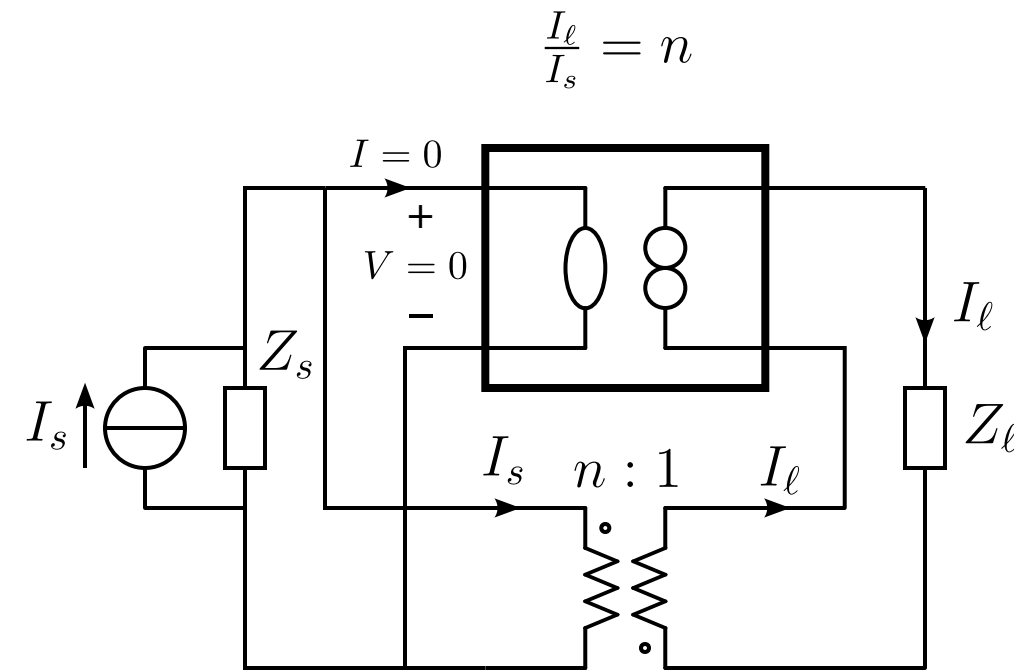
$$\frac{I_\ell}{I_s} = 1$$



## Passive feedback amplifier

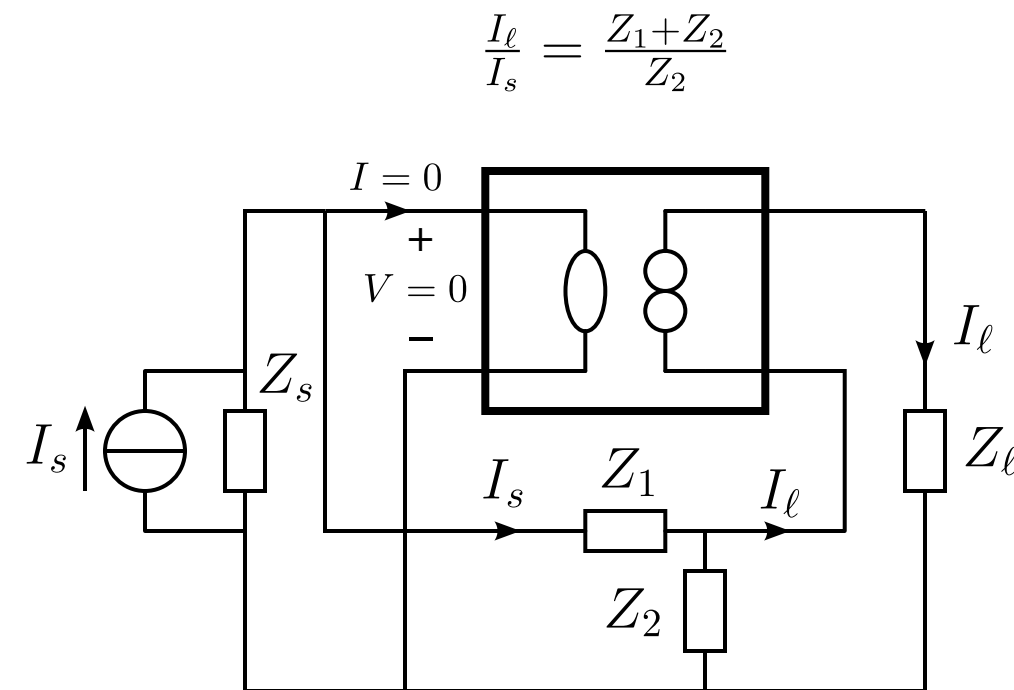
- no port isolation
- noninverting

# Negative Feedback Current Amplifier Configurations



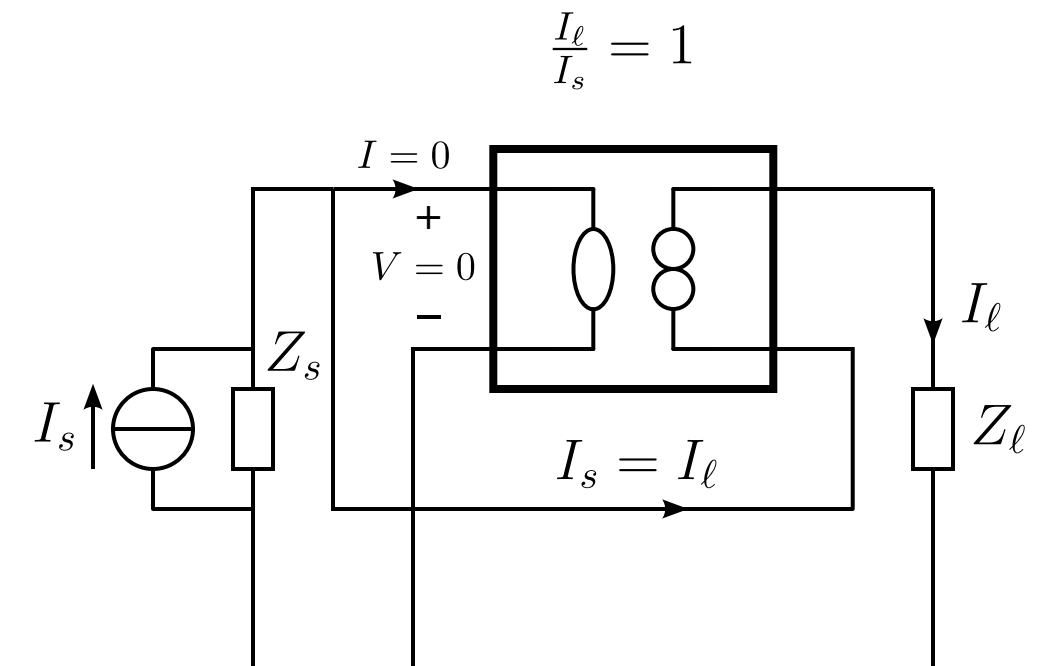
## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity

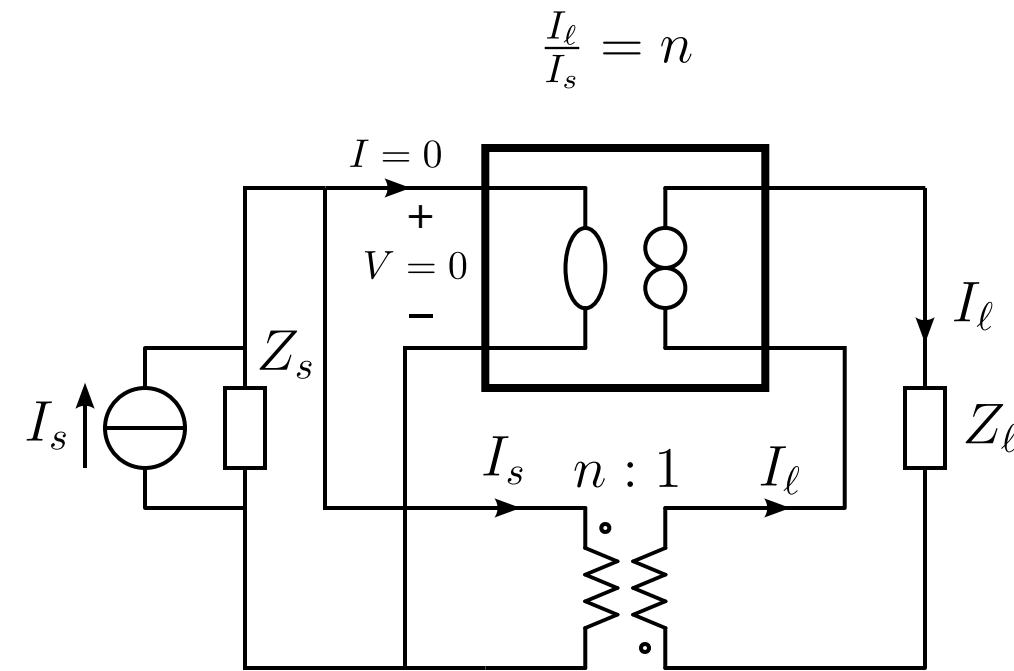


## Passive feedback amplifier

- no port isolation
- noninverting
- gain larger than unity

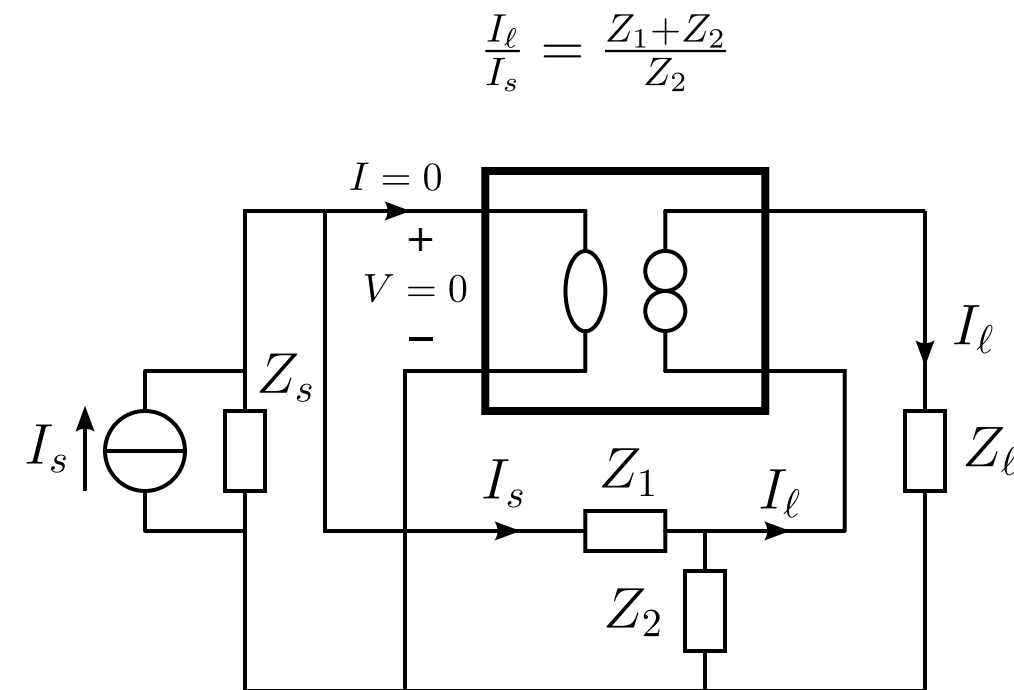


# Negative Feedback Current Amplifier Configurations



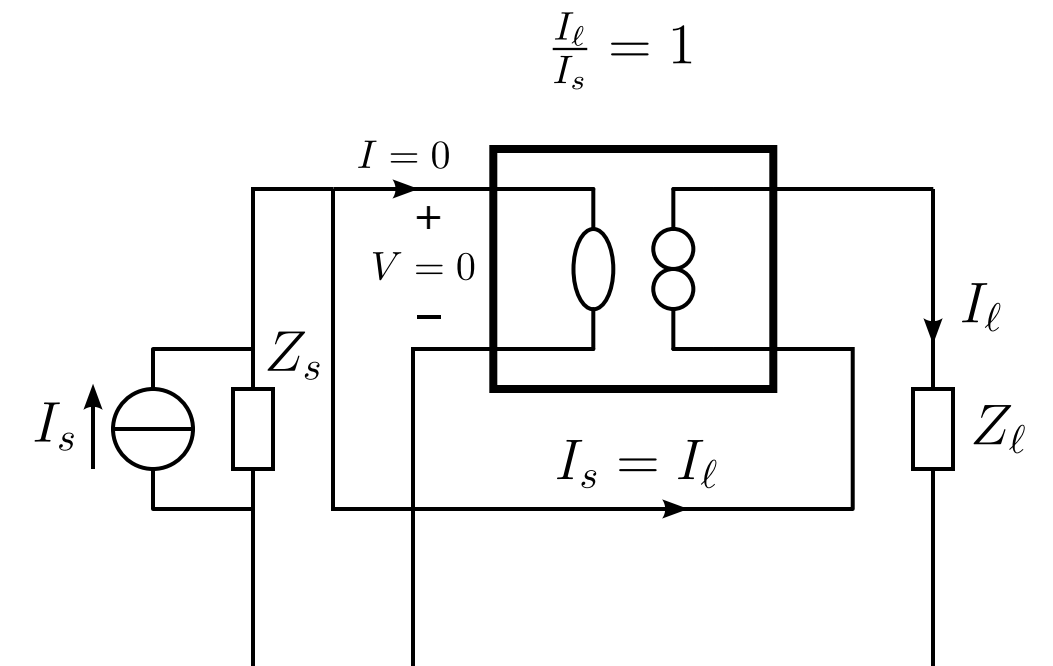
## Nonenergic feedback amplifier

- port isolation
- inverting or noninverting
- gain less, equal or larger than unity



## Nonenergic feedback follower

- no port isolation
- noninverting
- gain equals unity



## Passive feedback amplifier

- no port isolation
- noninverting
- gain larger than unity

# Negative Feedback Amplifier Configurations

Source type	Load type	Amplifier type	A, B, C, D	Feedback configuration
V	V	Voltage amplifier	A, 0, 0, 0	Output voltage sensing / parallel feedback Input voltage comparison / series feedback
V	I	Transadmittance	0, B, 0, 0	Output current sensing / series feedback Input voltage comparison / series feedback
I	V	Transimpedance	0, 0, C, 0	Output voltage sensing / parallel feedback Input current comparison / parallel feedback
I	I	Current amplifier	0, 0, 0, D	Output current sensing / series feedback Input current comparison / parallel feedback