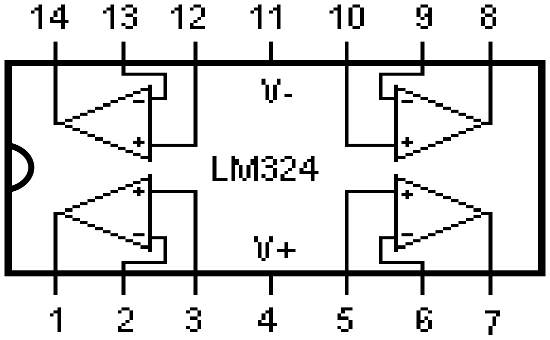
§ 5-1

(

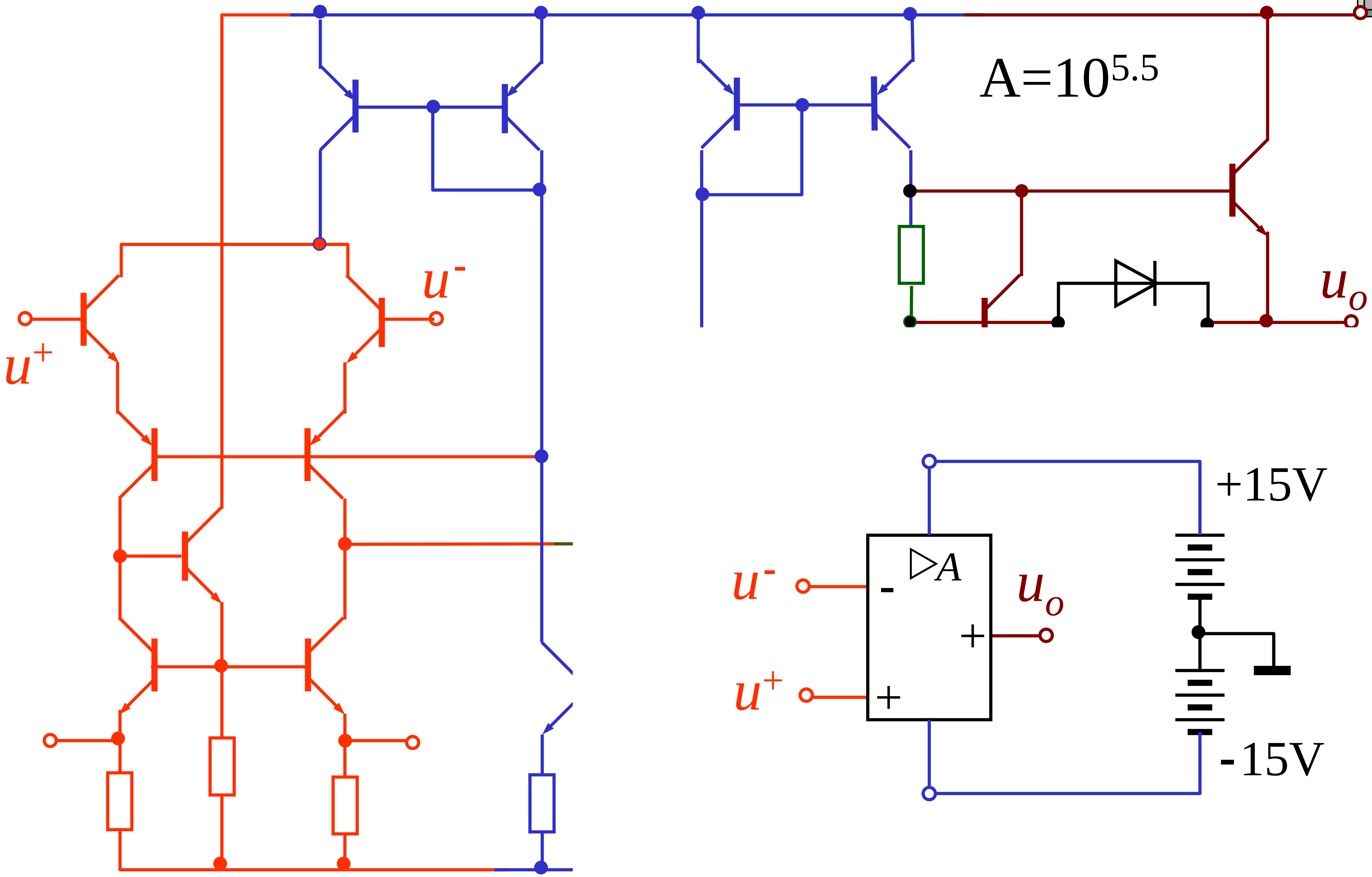
LM324N
W99109448
MALAYSIA
LM108H
B9442AB
LM324J
M51957B
03C9


14
13
12
11
10
9
8
V-
LM324
V+
1
2
3
4
5
6
7

3

F007 (A741)

$A=10^{5.5}$


u^+
u^-
u_o
u^-
u^+
▷A
-
+
+
u_o
+15V
-15V

2. ( )

(1) $|u_d|$

$u_o = A\,u_d$

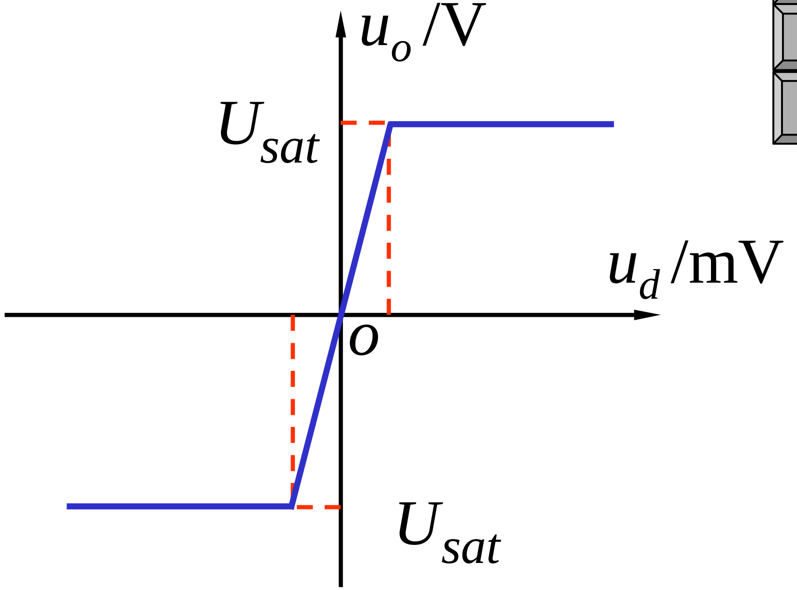
$$|u_d| \quad \left|\frac{u_o}{A}\right| \leq \left|\frac{\pm 13}{10^{5.5}}\right|$$

F007 $A \approx 10^{5.5}$

E_C ±15V

$U_{sat} \approx \pm 13\text{V}$

A



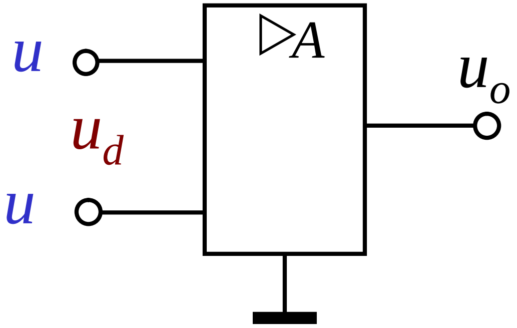
u_d

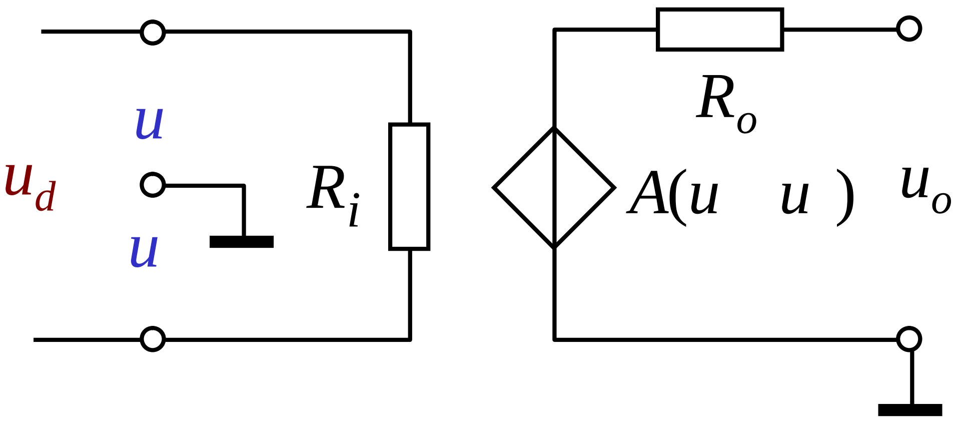
(2) $|u_d|$

$u_o \approx \pm U_{sat}$

u_d

3.




u
u_d
u
R_i
R_o
$A(u \quad u\ )$
u_o

R_i

$10^3 \quad 10^{12}$

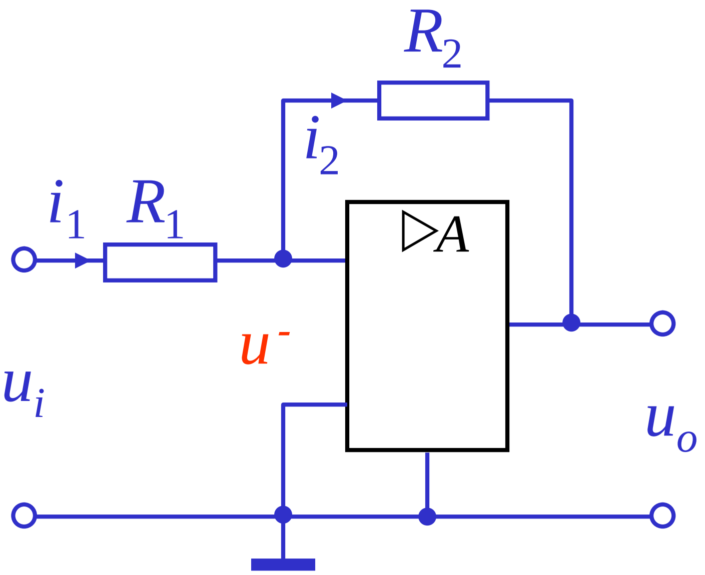
VCVS

u_o

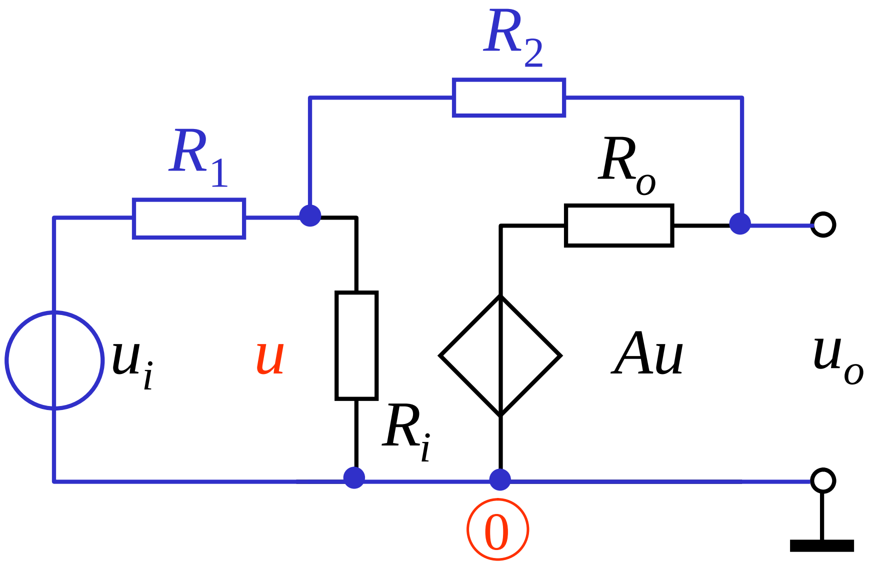
R_o

( )

§5 2



R_2
i_2
i_1
R_1
▷A
u^-
u_i
u_o

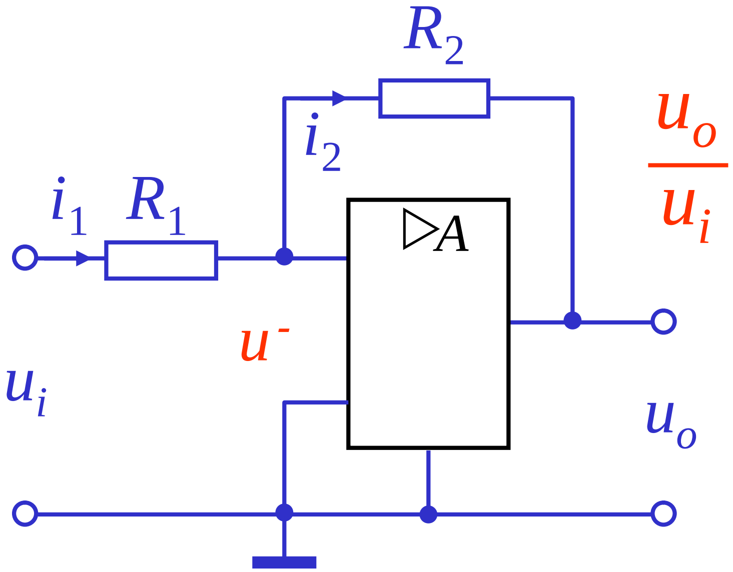


R_2
R_1
R_o
u_i
u
R_i
Au
u_o
0

u_o u_i u_{n1} u u_{n2} u

$$\begin{cases} \left(\frac{1}{R_1} \quad \frac{1}{R_i} \quad \frac{1}{R_2}\right) u \qquad \frac{1}{R_2} u_o \quad \frac{u_i}{R_1} \\ \frac{1}{R_2} u \quad \left(\frac{1}{R_o} \quad \frac{1}{R_2}\right) u_o \qquad \frac{Au}{R_o} \end{cases}$$

u



$$\frac{u_o}{u_i} \quad \frac{R_2}{R_1} \cdot \frac{1}{1 \quad \dfrac{\left(1 \quad \dfrac{R_2}{R_o}\right)\left(1 \quad \dfrac{R_2}{R_1} \quad \dfrac{R_2}{R_i}\right)}{A \quad \dfrac{R_o}{R_2}}}$$

A

$A \quad 10^7$

$$\frac{u_o}{u_i} \quad \frac{R_2}{R_1}$$

(1) R_1 R_2

$$u_o \quad \frac{R_2}{R_1} u_i$$

§ 5-3

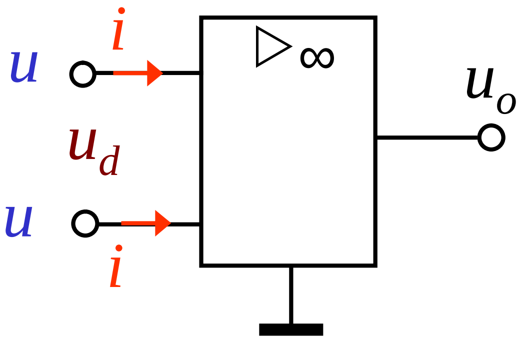
$A \to \infty \quad R_i \to \infty \quad R_o \quad 0$ · · ·

$R_i \to \infty \longrightarrow$ (1) $i \quad i \quad 0$

(“ ”)

$\frac{u_o}{A} \quad u_d \quad (u \quad u) \to 0 \longrightarrow$ (2) $u \quad u$

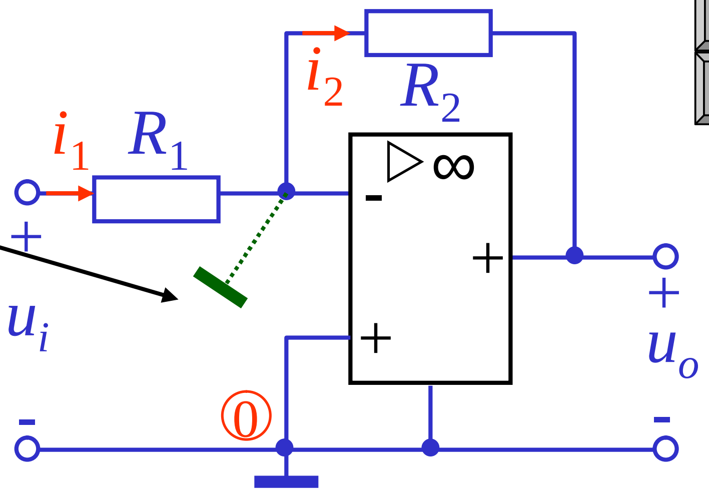
(“ ”)



2

1 $i_1 = i_2$

$$\frac{u_i}{R_1} = -\frac{u_o}{R_2} \longrightarrow \frac{u_o}{u_i} = -\frac{R_2}{R_1}$$



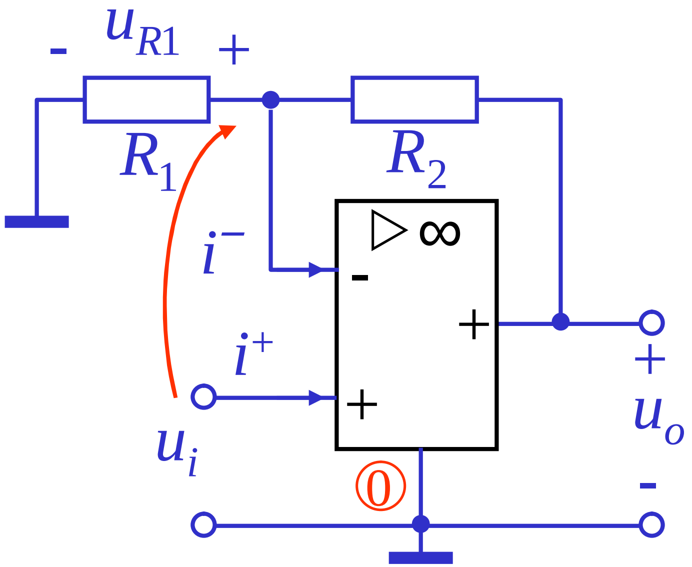
i_2
R_2
i_1
R_1
▷∞
-
+
+
+
u_i
-
⓪
+
u_o
-

1 R_1 R_2

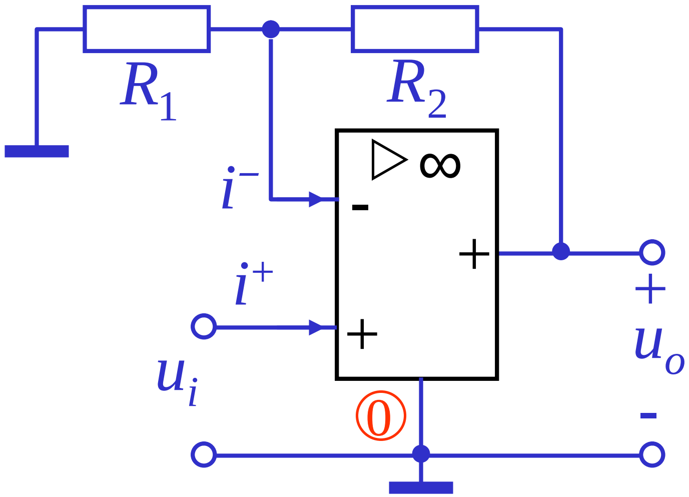
u_{R1} $\frac{R_1}{R_1+R_2}u_o$

2 u_{R1} u_i

$$u_o \quad \frac{R_1+R_2}{R_1}u_i \longrightarrow \frac{u_o}{u_i} \quad 1 \quad \frac{R_2}{R_1}$$

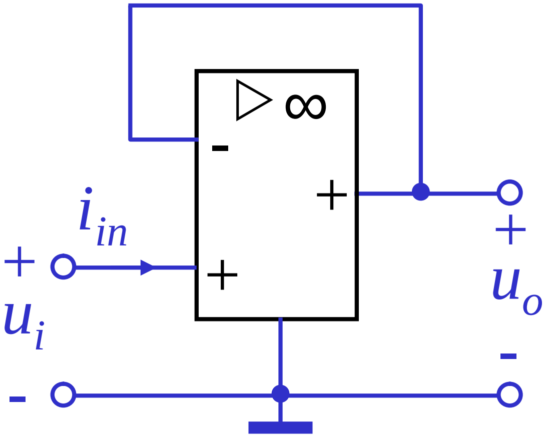


-
u_{R1}
+
R_1
R_2
▷∞
i^-
-
+
i^+
+
u_i
⓪
+
u_o
-


R_1
R_2
i^-
i^+
▷∞
-
+
+
u_i
⓪
+
u_o
-

$$\frac{u_o}{u_{in}} \quad 1 \quad \frac{R_2}{R_1}$$

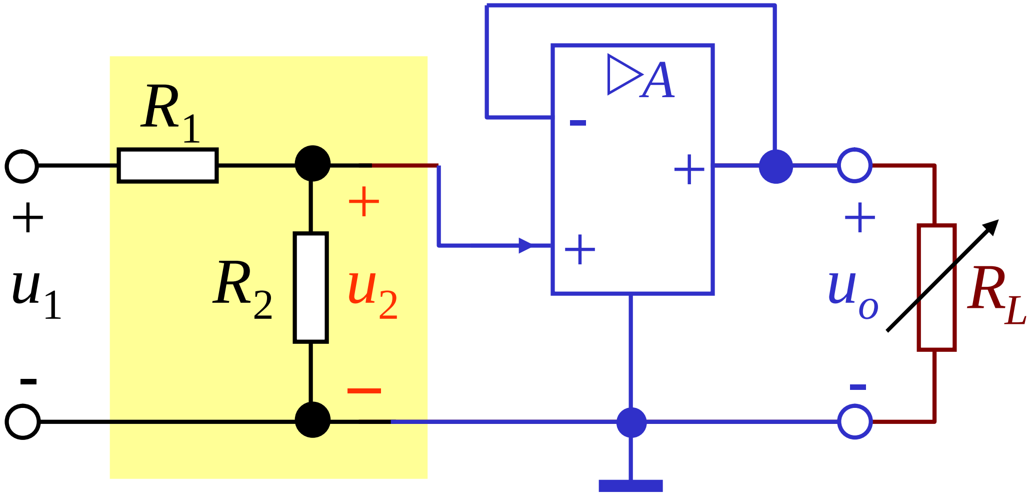
$$\xrightarrow[R_1]{R_2=0}$$



$u_o = u_i$

R_i “ ”

u_o


R_1
▷A
-
+
+
+
u_1
-
R_2
+
u_2
−
+
u_o
-
R_L

R_L

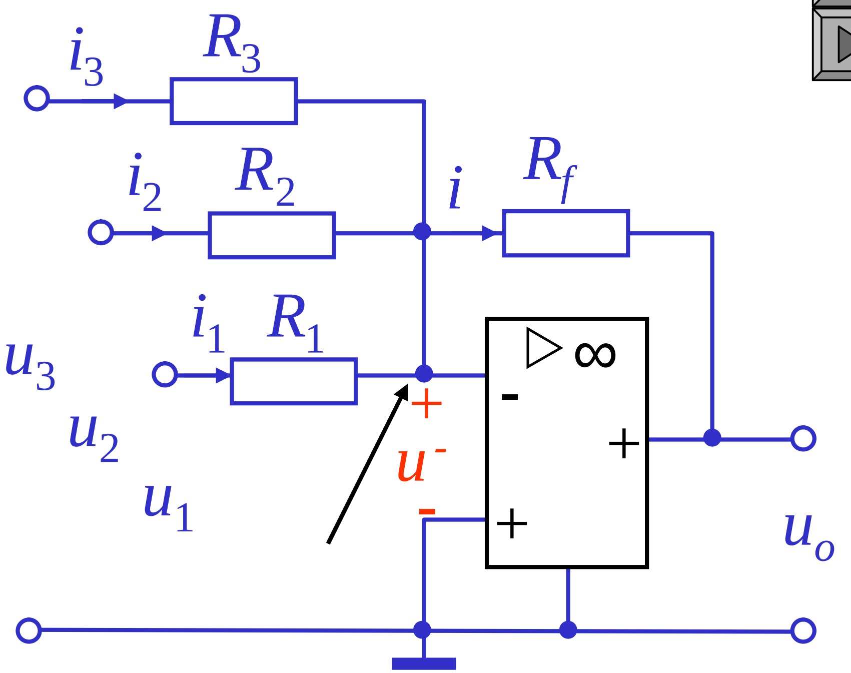
u_2 (u_o)

$i \quad 0$

$\therefore i_1 \quad i_2 \quad i_3 \quad i$

$$\frac{u_1}{R_1} \quad \frac{u_2}{R_2} \quad \frac{u_3}{R_3} \qquad \frac{u_o}{R_f}$$

$$u_o \quad \left(\underline{\underline{\frac{R_f}{R_1} u_1}} \quad \underline{\underline{\frac{R_f}{R_2} u_2}} \quad \underline{\underline{\frac{R_f}{R_3} u_3}} \right)$$


i_3
R_3
i_2
R_2
i
R_f
i_1
R_1
u_3
u_2
u_1
$+$
u^-
$-$
$\triangleright \infty$
$-$
$+$
$+$
u_o

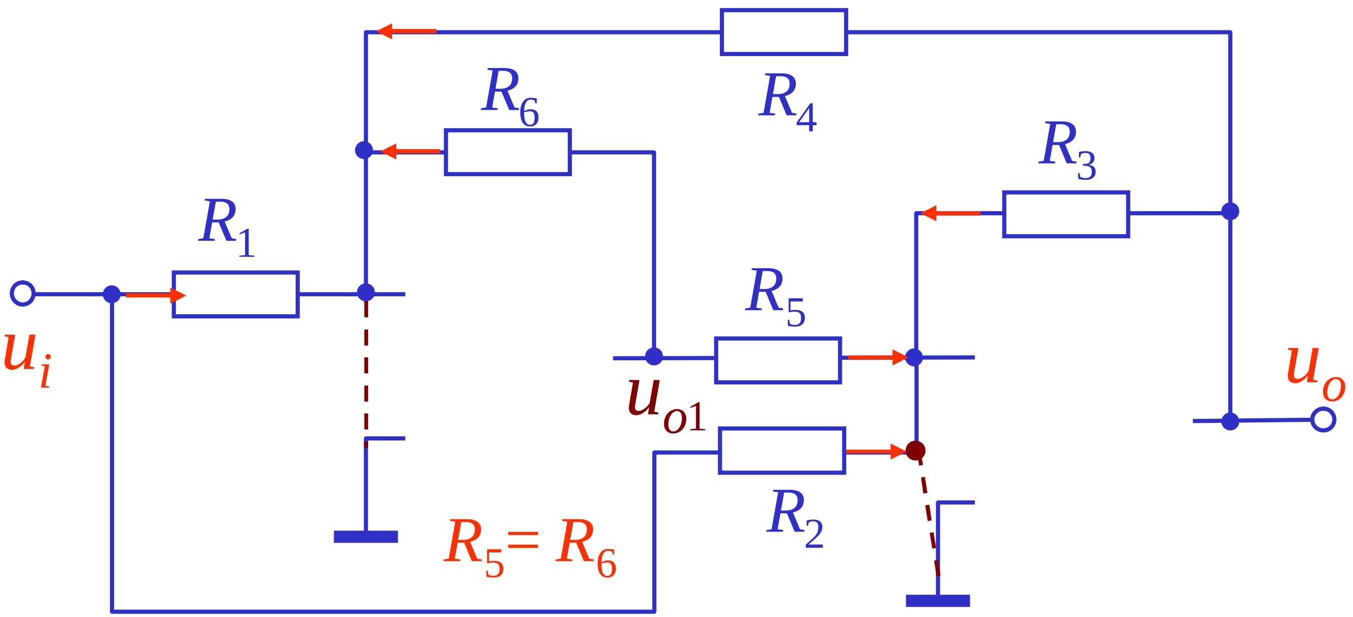
:

$$\left(\qquad \right) u_{n1} \quad \frac{u_1}{R_1} \quad \frac{u_2}{R_2} \quad \frac{u_3}{R_3} \quad \frac{u_o}{R_{f/}} \quad 0$$

$R_1 \quad R_2 \quad R_3 \quad R_f$

$u_o \quad (u_1 \quad u_2 \quad u_3)$

5–3


R_6
R_4
R_3
R_1
R_5
u_i
u_{o1}
u_o
R_2
$R_5= R_6$

$$\left.\begin{array}{ccc} \frac{u_i}{R_1} & \frac{u_o}{R_4} & \frac{u_{o1}}{R_6} \\[2ex] \frac{u_i}{R_2} & \frac{u_o}{R_3} & \frac{u_{o1}}{R_5} \end{array}\right\} \Rightarrow \frac{u_i}{R_1} \quad \frac{u_i}{R_2} \quad \frac{u_o}{R_4} \quad \frac{u_o}{R_3}$$

$$(G_1 \quad G_2)u_i \quad (G_3 \quad G_4)u_o$$

$$\frac{u_o}{u_i} \quad \frac{(G_1 \quad G_2)}{(G_3 \quad G_4)}$$

5 7 u_o

u_{s1} u_{s2} u_{S1} u_o