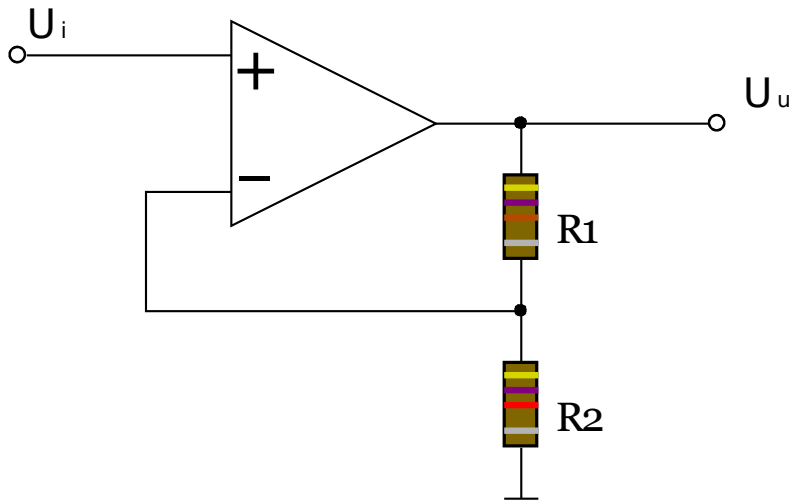


Non-inverting operational amplifier



Basic formulas:

feedback factor : $\beta = \frac{R_2}{R_1 + R_2}$

Amplification: $f = 1 + \frac{R_1}{R_2} \equiv R_1 = R_2 \cdot (f - 1) \equiv R_2 = \frac{R_1}{f - 1}$

Output voltage: $U_{out} = U \cdot f = U_{in} \cdot \left(1 + \frac{R_1}{R_2}\right) \quad U_{out} = U_{GND} + f \cdot (U_{in} - U_{GND})$

Combined adder and amplifier (ground voltage $\neq 0V$)

1. Signal amplification: $f_u = \frac{U_{out1} - U_{out2}}{U_{in1} - U_{in2}}$
2. Local GND fixed voltage: $U_{GND} = \frac{f \cdot U_{in} - U_{out}}{f - 1}$

Example

1. $U_{in} = \frac{1}{2} V$, $U_{out} = 5V$
2. $U_{in} = -\frac{1}{2} V$, $U_{out} = 0V$

First, find amplification: $f = \frac{U_{u1} - U_{u2}}{U_{i1} - U_{i2}} = \frac{5 - 0}{\frac{1}{2} - \left(-\frac{1}{2}\right)} = \underline{\underline{5 \text{ times}}}$

Then find fixed voltage U_{gnd} : $U_{GND} = \frac{f \cdot u_i - u_u}{f - 1} = \frac{5 \cdot \frac{1}{2} - 5V}{5 - 1} = \underline{\underline{-0.625V}}$