Dr Satvir Singh

LINEAR INTEGRATED CIRCUITS

3-05

V to I and I to V Converter

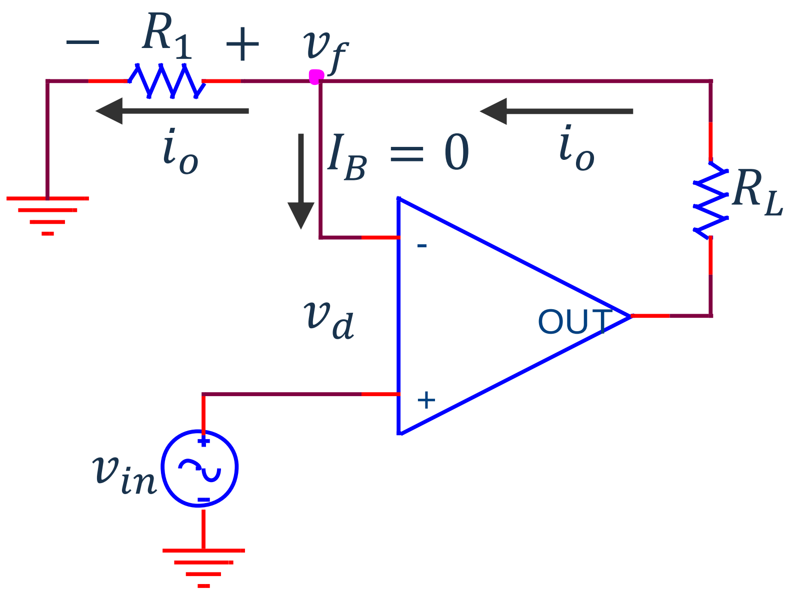
Voltage to Current Converter – I

In the shown circuit, load resistance R_L is floating (i.e., load resistance is not connected to ground).

The differential input $v_d = v_{in} - v_f \approx 0$, therefore,

$$v_{in} = v_f = i_o R_1$$

$$i_o = \frac{v_{in}}{R_1}$$



The input voltage v_{in} is converted into current $\frac{v_{in}}{R_1}$, that flows through load resistance R_L.

Load current i_o can be precisely controlled using R_1

Voltage to Current Converter – II

In the shown circuit, load resistance R_L is grounded

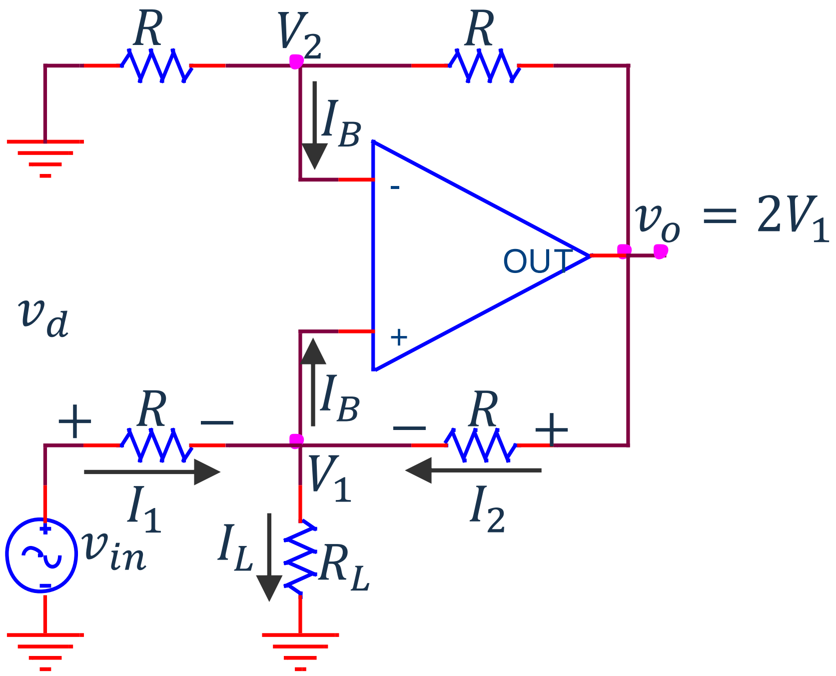
Applying KCL at node V_1

$$I_L = I_1 + I_2$$

$$I_L = \frac{v_{in} - V_1}{R} + \frac{v_o - V_1}{R}$$

$$v_{in} + v_o - 2V_1 = I_L R$$

$$V_1 = \frac{v_{in} + v_o - I_L R}{2}$$



Voltage gain of the non-inverting amplifier is $1 + \frac{R}{R} = 2$

Output voltage of the amplifier is

$$v_o = v_{in} + v_o - I_L R \qquad \rightarrow \qquad I_L = v_{in}/R$$

Current to Voltage Converter

The shown circuit is an inverting amplifier

Output voltage is given as

$$v_o = -\frac{R_F}{R_1} v_{in} \qquad (1)$$

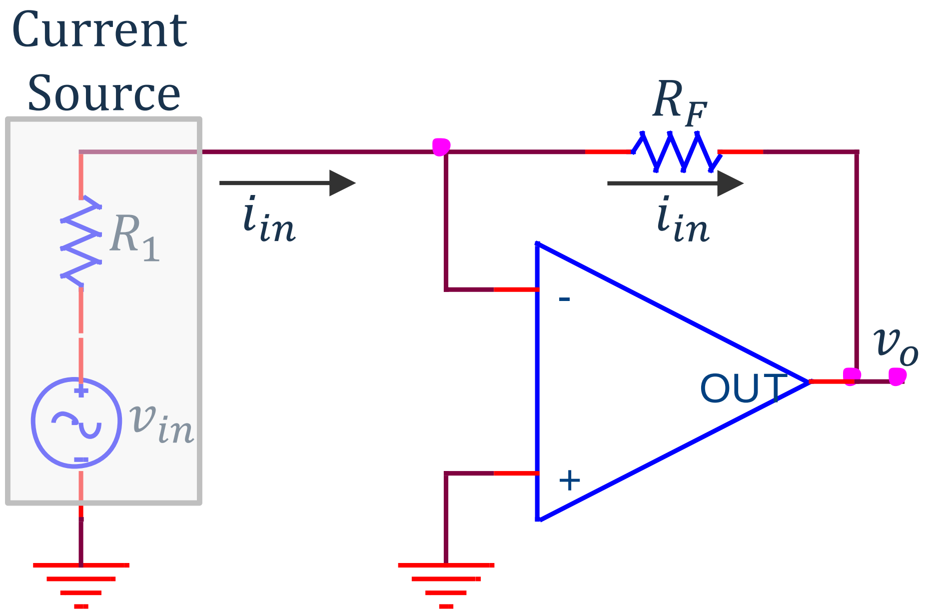
If i_{in} is the input current

$$i_{in} = \frac{v_{in}}{R_1}$$

Output voltage from (1)

$$v_o = -i_{in} R_F$$

Hence, the circuit converts input current into voltage



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Thank You