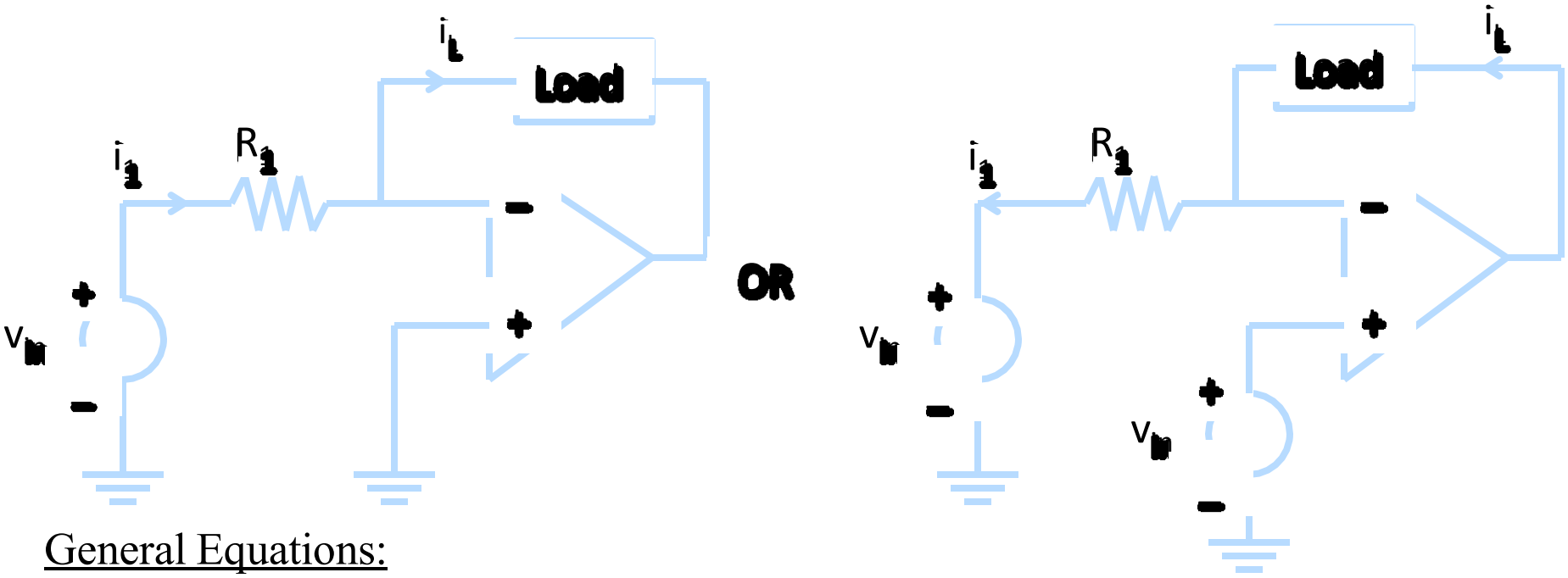
UNIT-2
Lecture-3

V-I and I-V converters, generalized Impedance converter

VCIS (Transconductance Amplifier) Summary

Voltage to Current Converter



General Equations:

$i_L = i_1 = v_1/R_1$

$v_1 = v_{in}$

The transconductance, $g_m = i_o/v_{in} = 1/R_1$

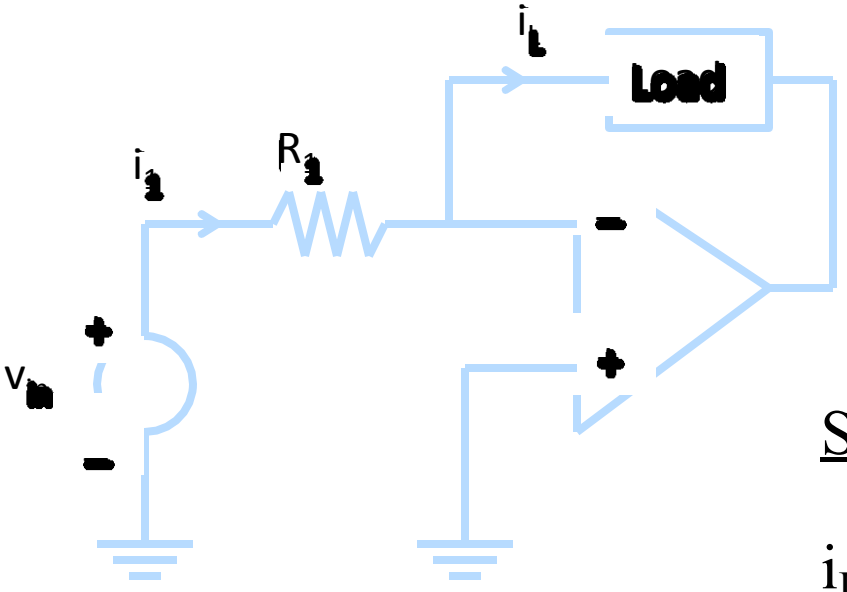
Therefore, $i_L = i_1 = v_{in}/R_1 = g_m v_{in}$

The maximum load resistance is determined by:

$R_{L(max)} = v_{o(max)}/i_L$

VCIS (Transconductance Amplifier)

Voltage to Current Converter Example



Given: $v_{in} = 2$ V, $R_1 = 2$ kΩ

$v_{o(max)} = 10$ V

Find: i_L, g_m and $R_{L(max)}$

Note:

- If $R_L > R_{L(max)}$ the op amp will saturate
- The output current, i_L is independent of the load resistance.

Solution:

$i_L = i_1 = v_{in}/R_1 = 2 / 2000 =$ 1 mA

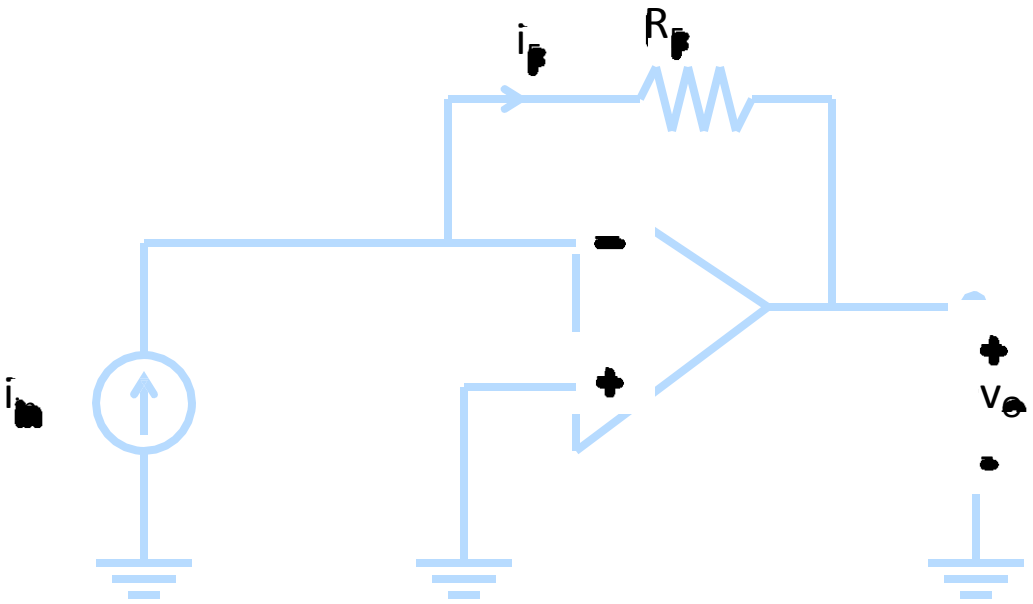
$g_m = i_o/v_{in} = 1/R_1 = 1 / 2000 =$ 0.5 mS

$R_{L(max)} = v_{o(max)}/i_L = 10$ V / 1 mA

$=$ 10 k Ω

VCIS (Transresistance Amplifier) Summary

Current to Voltage Converter



<u>General Equations:</u>

$i_F = i_{in}$

$v_o = -i_F R_F$

$r_m = v_o / i_{in} = R_F$

VCIS (Transresistance Amplifier) Summary

Current to Voltage Converter

- Transresistance Amplifiers are used for low-power applications to produce an output voltage proportional to the input current.
- Photodiodes and Phototransistors, which are used in the production of solar power are commonly modeled as current sources.
- Current to Voltage Converters can be used to convert these current sources to more commonly used voltage sources.