SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 19EE101-BASIC ELECTRICAL & ELECTRONICS ENGINEERING

I YEAR /I SEMESTER CSE & CST

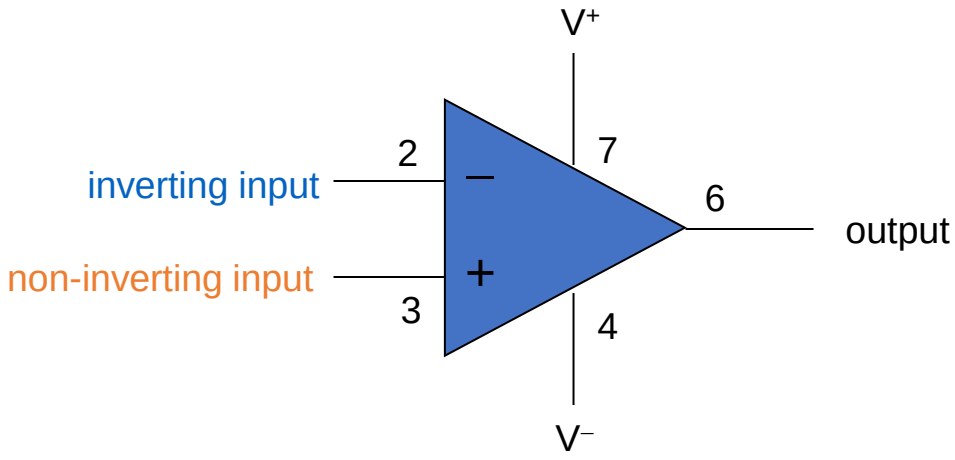
Unit 5: Linear and Digital Electronics

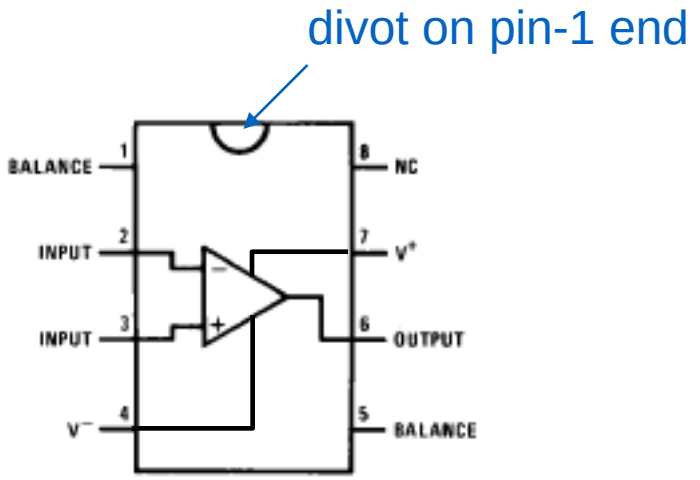
Topic : Inverting and Non Inverting Amplifier

GRADUATE ATTRIBUTES

REVIEW OF OPERATIONAL AMPLIFIER

- Op-amps (amplifiers/buffers in general) are drawn as a triangle in a circuit schematic
- There are two inputs
  - inverting and non-inverting
- And one output
- Also power connections (note no explicit ground)



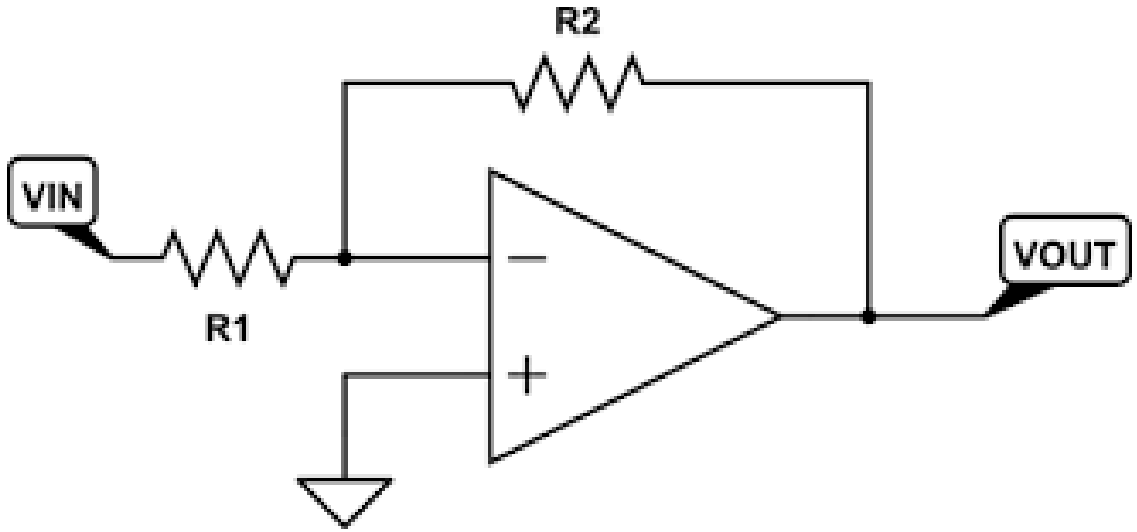


GOLDEN RULES OF OP-AMP

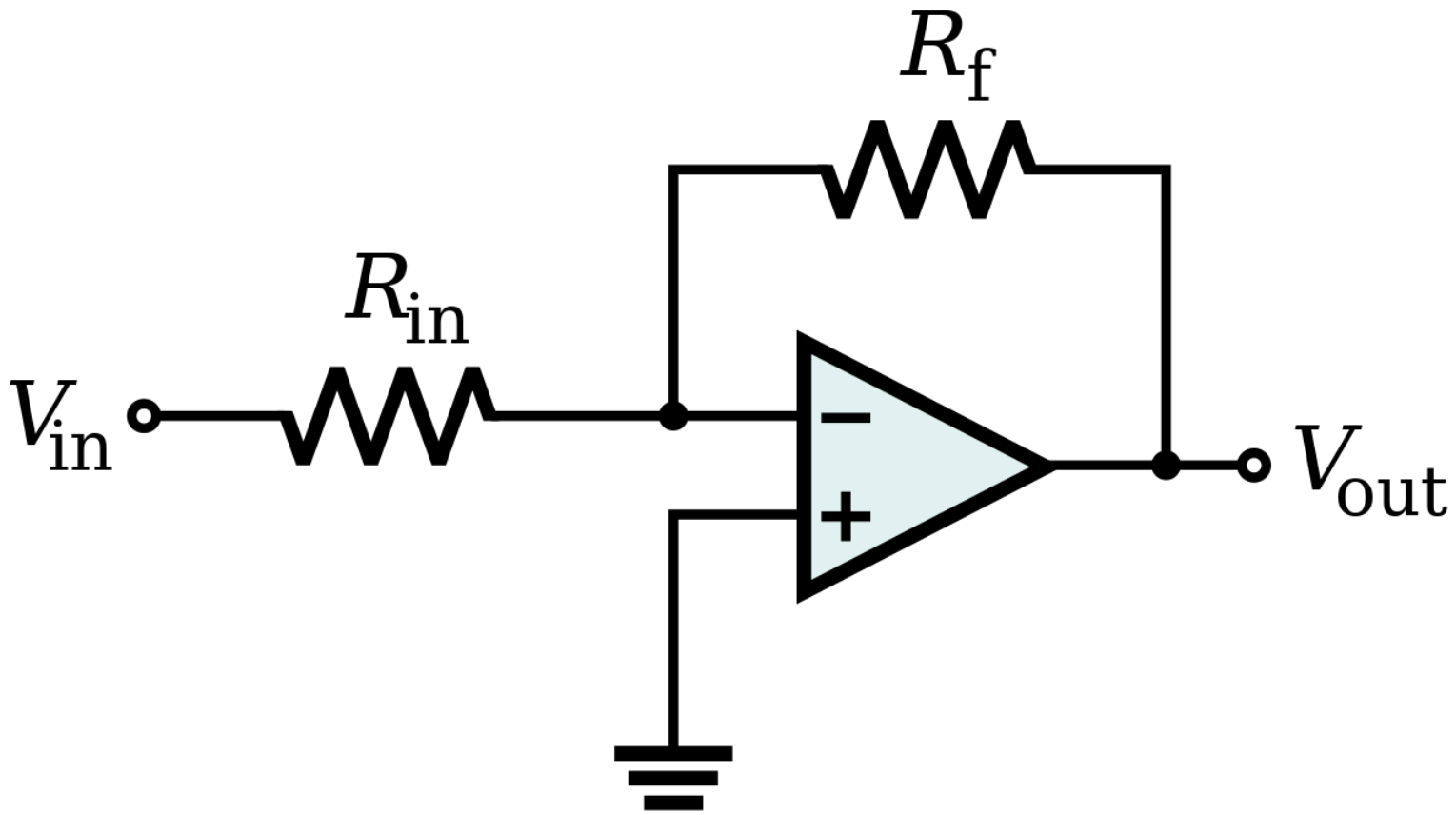
When an op-amp is configured in *any* negative-feedback arrangement, it will obey the following two rules:

The inputs to the op-amp draw or source no current (true whether negative feedback or not)

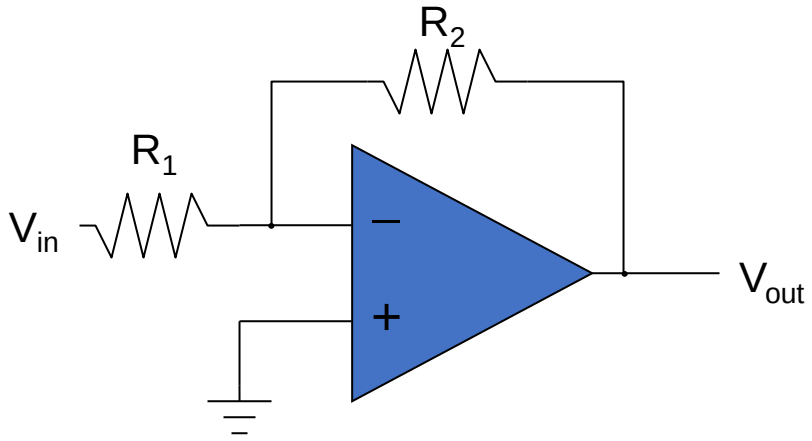
The op-amp output will do whatever it can (within its limitations) to make the voltage difference between the two inputs zero



INVERTING AMPLIFIER

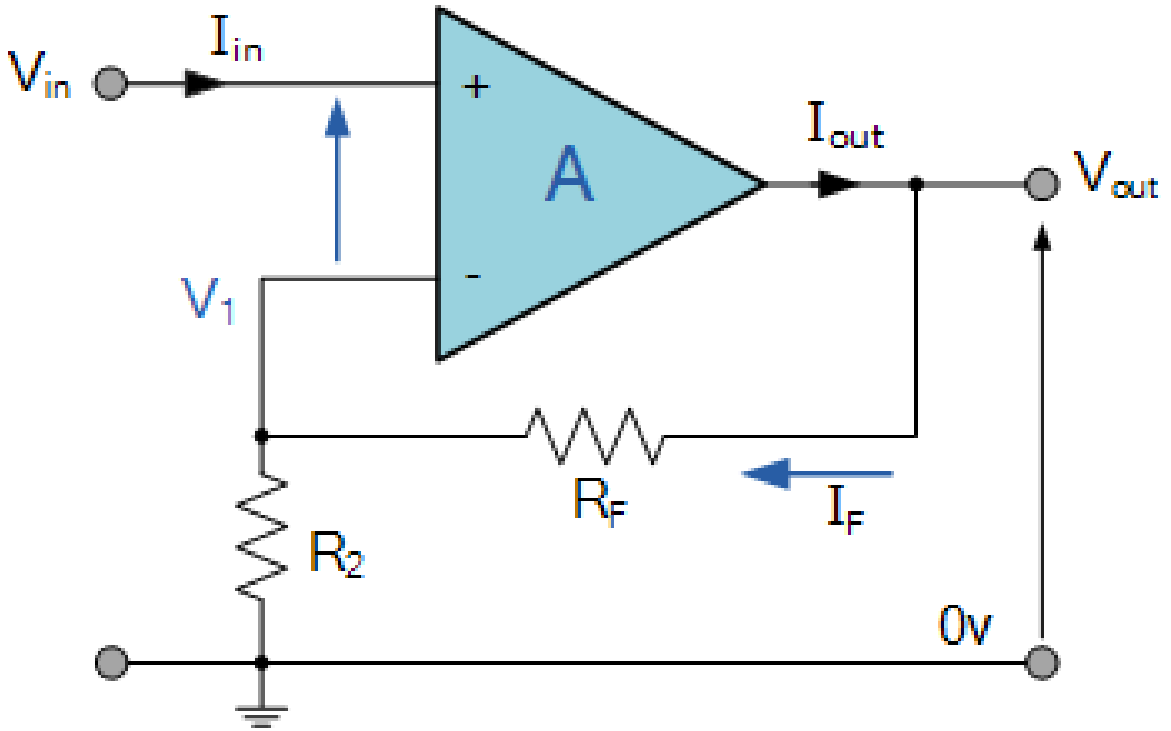


OPERATIONAL AMPLIFIER

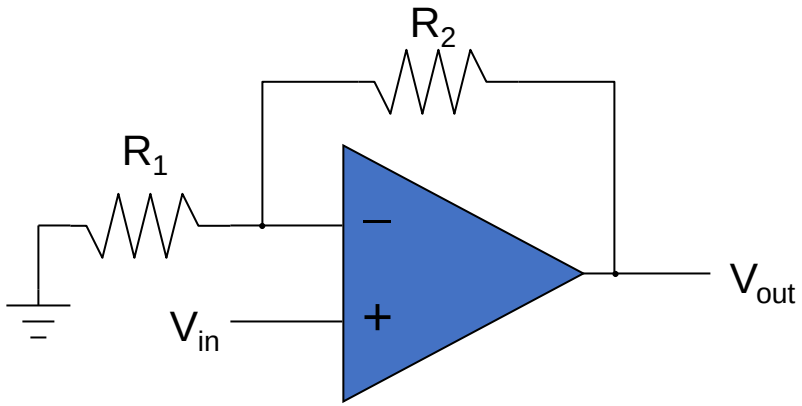


- Applying the rules: – terminal at "virtual ground" so current through R_1 is $I_f = V_{in}/R_1$
- Current does not flow into op-amp (one of our rules)
  - so the current through R_1 must go through R_2
  - voltage drop across R_2 is then $I_f R_2 = V_{in} \times (R_2/R_1)$
- So $V_{out} = 0 - V_{in} \times (R_2/R_1) = -V_{in} \times (R_2/R_1)$ Thus we amplify V_{in} by factor $-R_2/R_1$
  - negative sign earns title "inverting" amplifier
- Current is *drawn into* op-amp output terminal

NON INVERTING AMPLIFIER



OPERATIONAL AMPLIFIER



- Now neg. terminal held at V_{in} . so current through R_1 is $I_f = V_{in}/R_1$ (to left, into ground)
- This current cannot come from op-amp input
  - so comes through R_2 (delivered from op-amp output)
  - voltage drop across R_2 is $I_f R_2 = V_{in} \times (R_2/R_1)$
  - so that output is higher than neg. input terminal by $V_{in} \times (R_2/R_1)$
  - $V_{out} = V_{in} + V_{in} \times (R_2/R_1) = V_{in} \times (1 + R_2/R_1)$
  - thus gain is $(1 + R_2/R_1)$, and is positive
- Current is sourced from op-amp output in this example

REFERENCES

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3. Mehta V K, Mehta Rohit, “Principles of Electrical Engineering and Electronics”, S.Chand & Company Ltd, (2010)- UNIT I and II
4. Mehta V K, Mehta Rohit, “Principles of Electronics”, S.Chand & Company Ltd, (2005)- UNIT IV and V

THANK YOU