Lecture22:
Operational amplifier (1)

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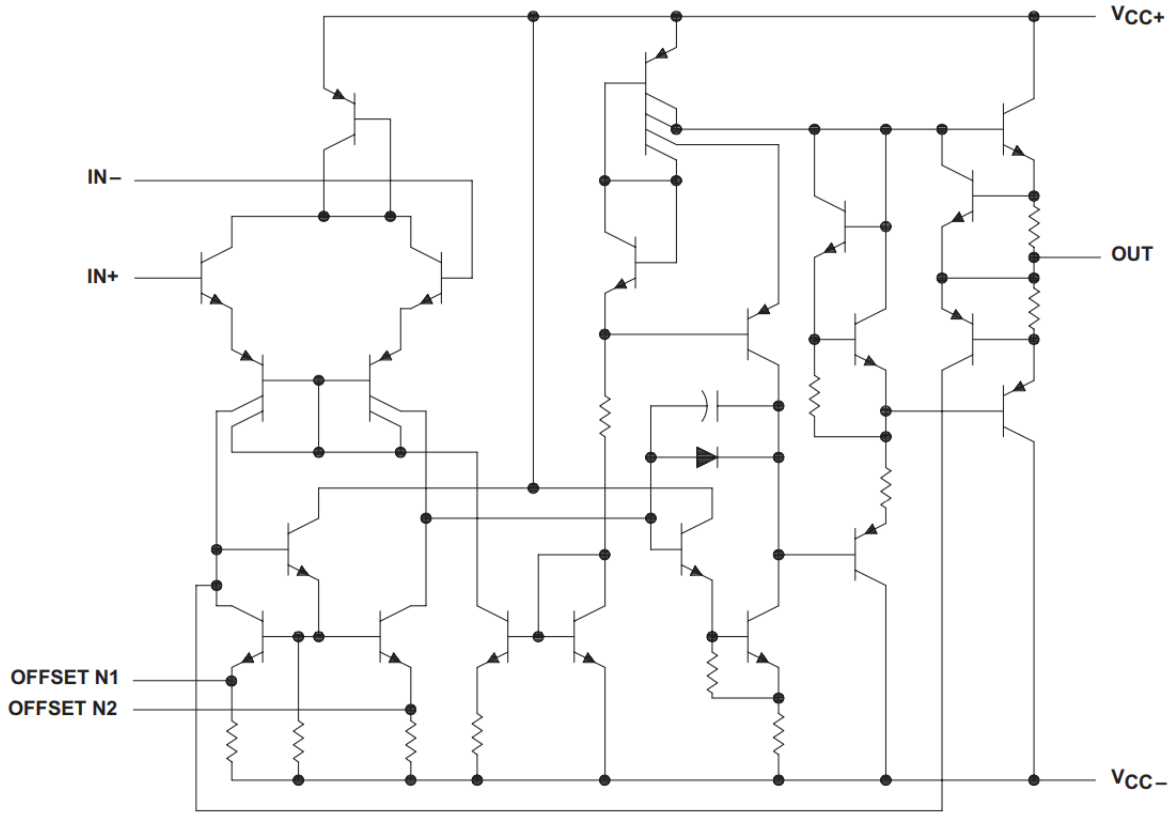
Operational amplifier

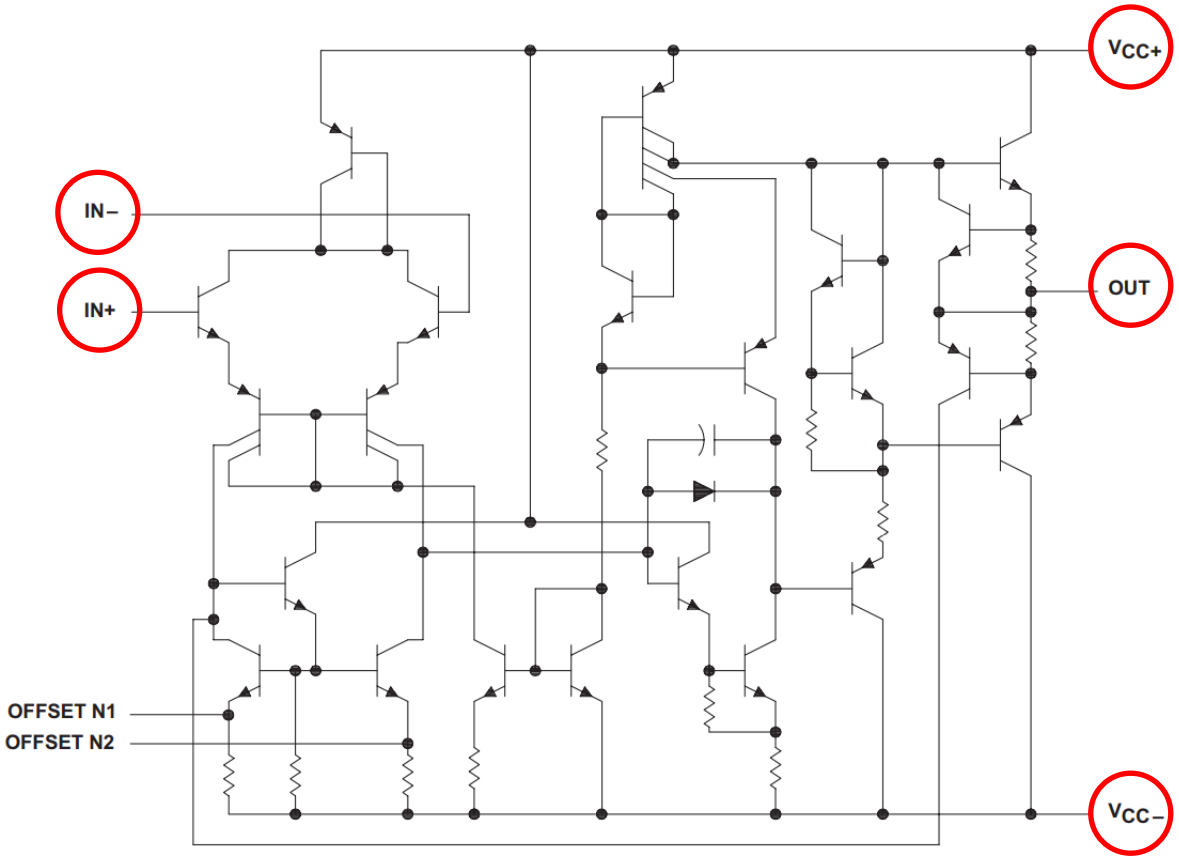
- As a black box
  - We will follow Razavi's book.
- Its inside

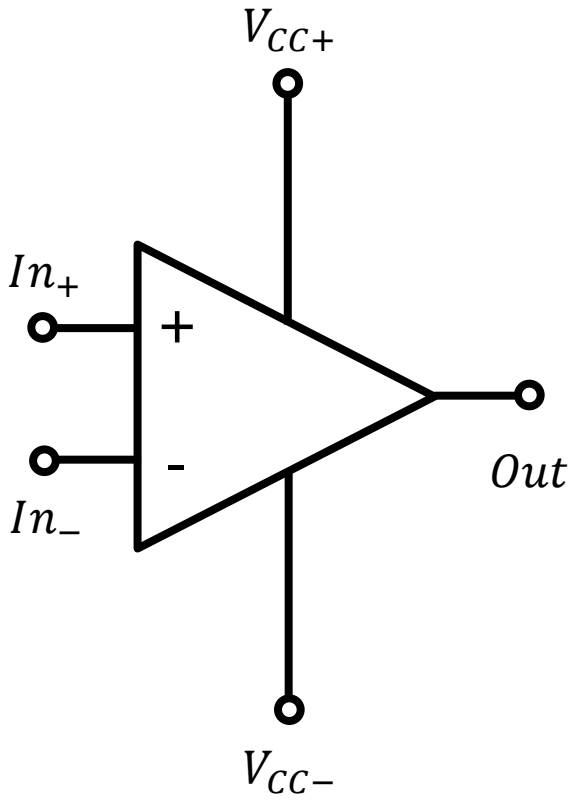


Circuit schematic of a 741 op amp (Texas Instruments)

Symbol

- It is a differential amplifier with a single output.



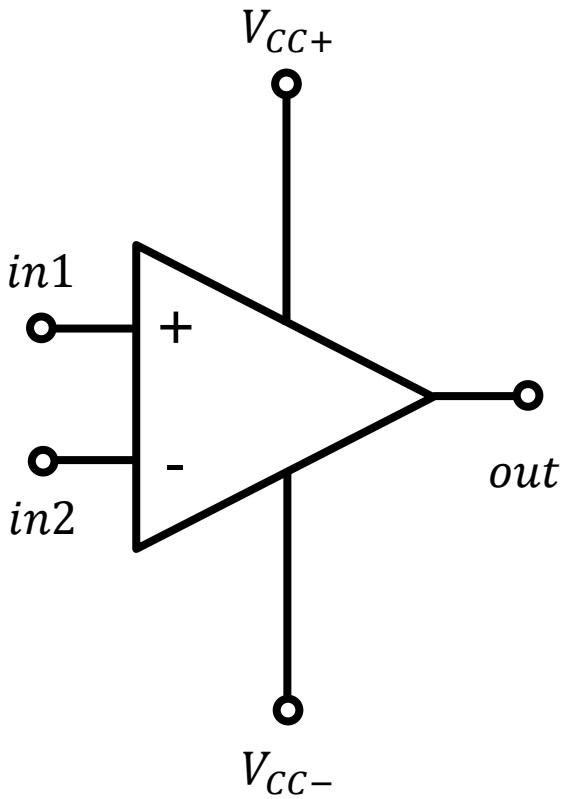


Open-loop gain

- The open-loop gain, A_0
  - The output voltage is given by

$$V_{out} = A_0(V_{in1} - V_{in2})$$

  - Noninverting input: V_{in1}
  - Inverting input: V_{in2}



PARAMETER		TEST CONDITIONS(1)		MIN	TYP	MAX	UNIT
A_{VD}	Large-signal differential voltage amplification	$R_L \geq 2\ k\Omega$	25°C	20	200		V/mV
		$V_O = \pm 10\ V$	Full range	15			

Open-loop gain of a 741 op amp (Texas Instruments)

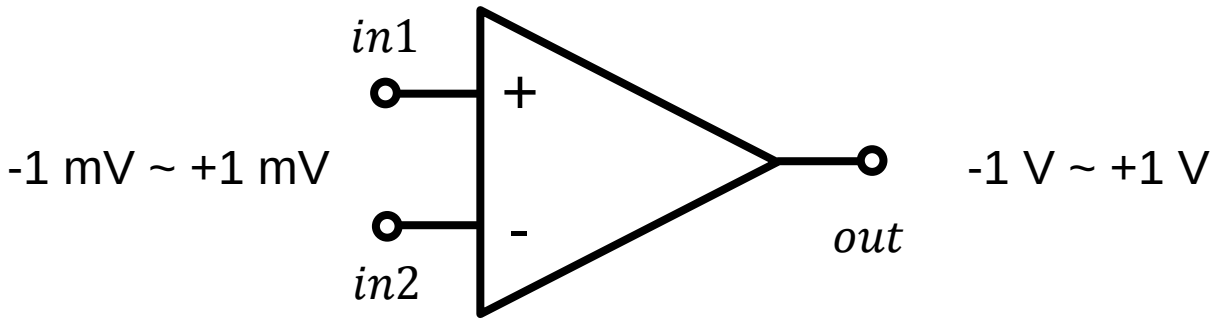
Very large open-loop gain

- If the output voltage is bounded,
  - The difference between two inputs is also bounded.

$$V_{out} = A_0(V_{in1} - V_{in2})$$

  - Since the open-loop gain is very large,

$$V_{in1} - V_{in2} = \frac{V_{out}}{A_0} \approx 0$$

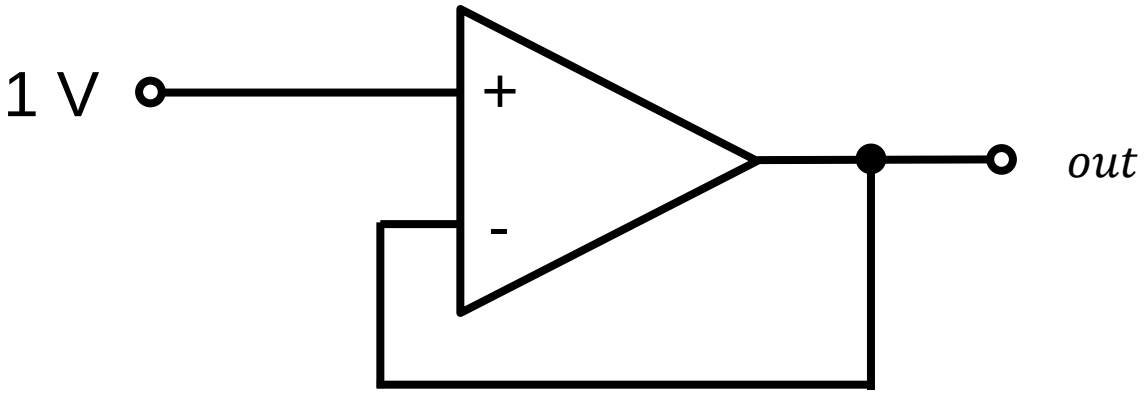


Open-loop gain of 1000

Example 8.1

- "Unit-gain" buffer
  - What is V_{out}?

$$V_{out} = A_0(1 - V_{out})$$



Homework#10 (Last one)

- Due: 09:00, June 4
- Solve the following problems of the final exam in 2017.
  - P44
  - P45
  - P46
  - P47
  - P48
  - P49
  - P50