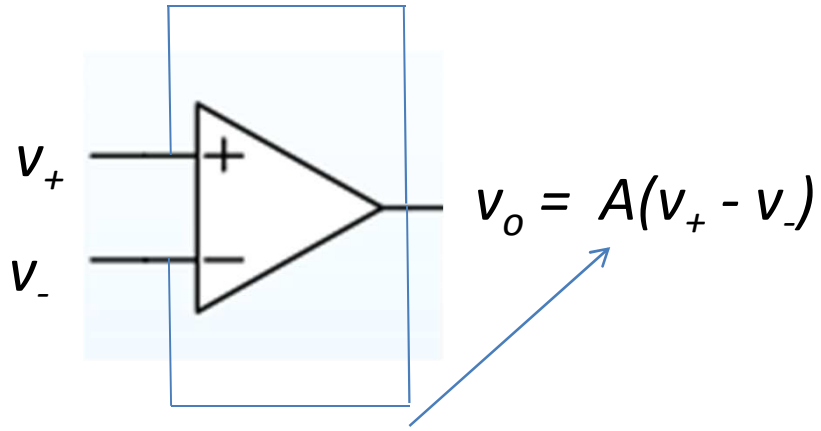
Lecture 3
Negative Feedback



Open Loop: A ~ 10^5 almost never used

NEGATIVE feedback is **BETTER** than **POSITIVE** feedback

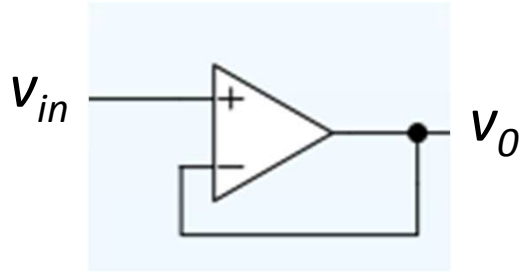
Consider a Heater control System:

When the temperature falls, the heater turns on

When the temperature rises, the heater turns off

Let v_{in} represent input from a thermometer

v_0 represent the control signal to the heater: v_0 high → heater on



When it's cold, v_{in} falls → v_o falls → v_- decreases → $(v_+ - v_-)$ increases → $v_o = A(v_+ - v_-)$ will tend to <u>rise</u> i.e. heater turns on.

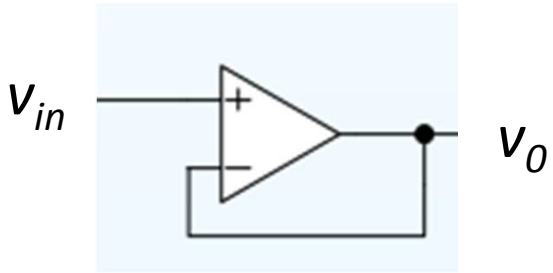
NEGATIVE feedback: something happens→ the system tries counteract it

Simple Negative feedback

Consider a Heater control System:

When the temperature falls, the heater turns on

When the temperature rises, the heater turns off



$v_o = A(v_+ - v_-)$

$v_o = A(v_{in} - v_o)$

$v_o\,(1+A) = A\,v_{in}$

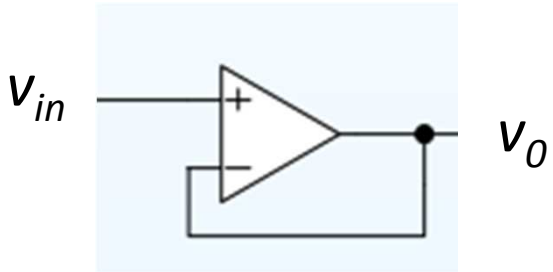
$$v_0 = \frac{1}{1 + {}^{1}/_{A}}\, v_{in} \rightarrow \boldsymbol{v_0 = v_{in}}$$

A large

In steady state, v_0 *tracks* v_{in}

Negative feedback makes inputs equal

v_+ and v_- are equal – how and why ?



$v_o = A(v_+ - v_-)$

$$v_+ - v_- = \frac{1}{A} v_o \rightarrow \boldsymbol{v_- \sim v_+}$$

Output does whatever it can to make the inputs equal

Golden Rules of Negative Feedback

1. Output does whatever it can to make inputs equal
   v_- is 'slave' to v_+ in negative feedback

2. Inputs draw no current

Summary

Today:

- Negative feedback
- Golden Rules I and II of negative feedback