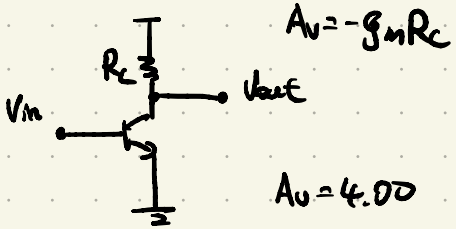
Lec 27

- Intro. to Feedback
- General Feedback System
- "Closed-Loop" Transfer Function

- Examples of Negative Feedback

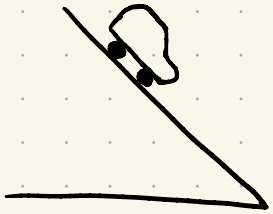
  1) Pupil 瞳孔 shrinks when go to a bright room

- Why negative feedback ?



$A_v = -g_m R_c$

$A_v = 4.00$



Without feedback we have "untamed" and "poorly-controlled" circuit and systems

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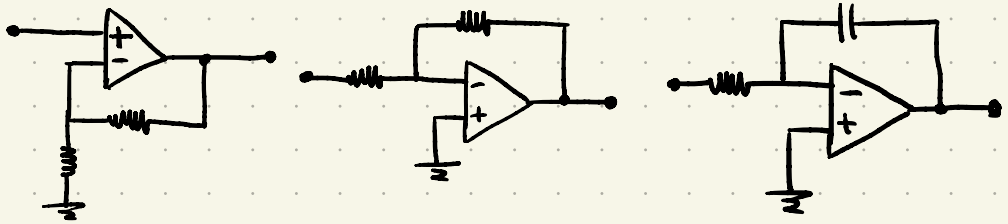
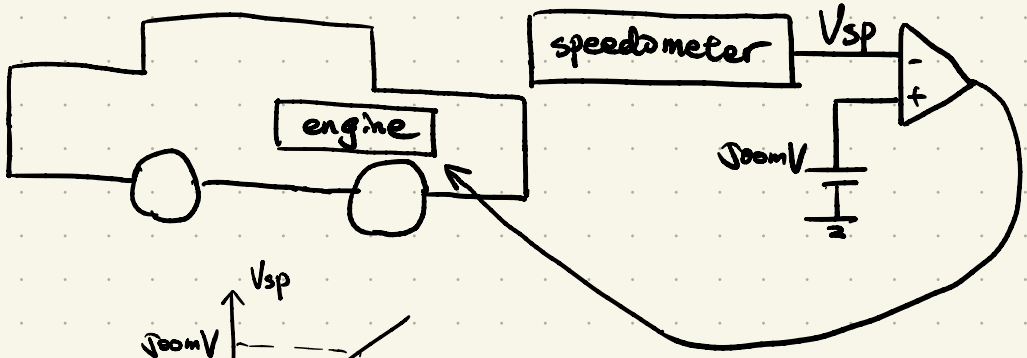
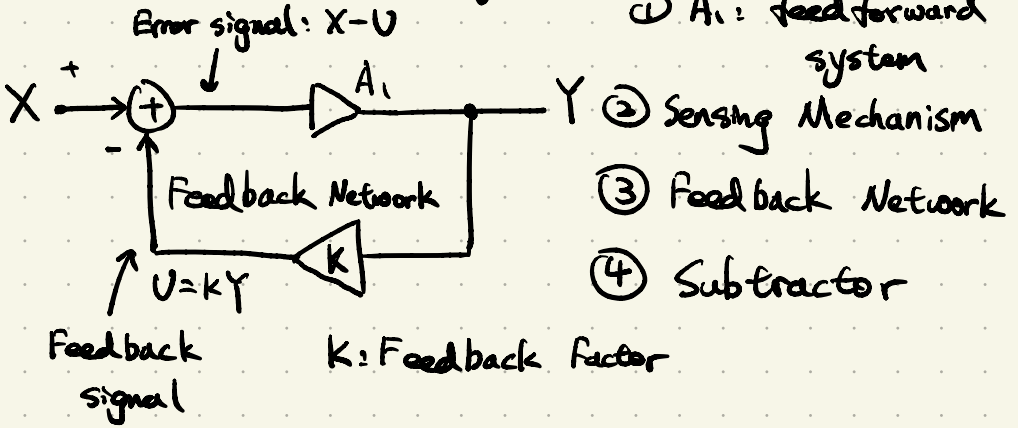
- We have seen negative feedback before:



- Let's build a cruise control system:



- General Feedback System



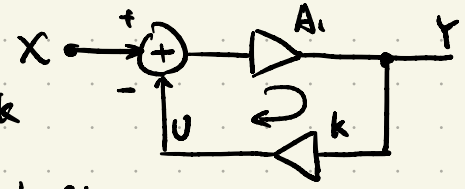
① A_1: feedforward system

② Sensing Mechanism

③ Feedback Network

④ Subtractor

Notes



① Negative Feedback

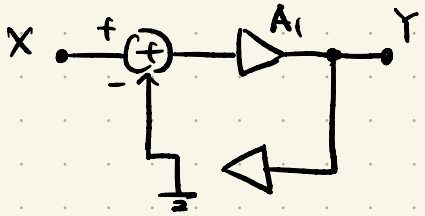
② Direction of signal flow

③ Error Signal = X − U must be minimized.

How and Why ?

④ Open-Loop System Closed-Loop System

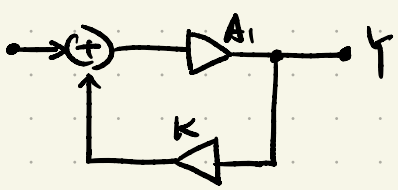
$k=0$



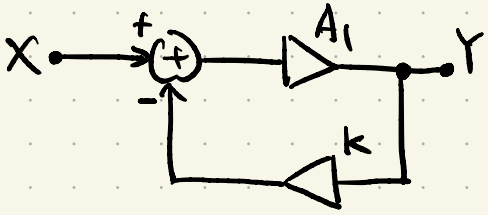
$\equiv$ 

(mostly)

$k \neq 0$



- Transfer Function of Closed-Loop System



$\frac{Y}{X} = ?$

Error Signal = $X - kY$

$Y = A_1(X - kY)$

$\frac{Y}{X} = \frac{A_1}{1+kA_1}$ A_1 : open-loop gain

$\frac{A_1}{1+kA_1}$: closed-loop gain

$k, A_1 > 0$

$\Rightarrow$ closed-loop gain < open-loop gain

- Why do we reduce the gain?
- How do we implement the subtractor?
- What is the purpose of the feedback network?

Q: Find error signal in terms of X

$$\text{Error} = X - U = X - kY = X - \frac{kA_1X}{1+kA_1}$$

$$= \frac{X}{1+kA_1}$$

Observation: If error is minimized,

$X - U$ becomes small $\Rightarrow X \approx U$

$\Rightarrow$ Feedback signal is a good copy of the input