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Week 13 lecture 1 - Activity

1. Braking of an vehicle

input (u) - force on brake padel
output (y) - Reduction of speed of vehicle
System components - Brake padel
Brake servo pump
Brake lines
Brake pads
Brake discs

~~Pressing~~ Typing a letter on computer.

input (u) - Pressure on the key
output (y) - displaying of the disired letter.
System components - Switch in key
Processor
Display

Switch on a bulb

input (u) - changing state of switch
output (y) - light bulb on
System components - Switch
Wires
relays
Bulb

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2. Downshifting of gear in a car

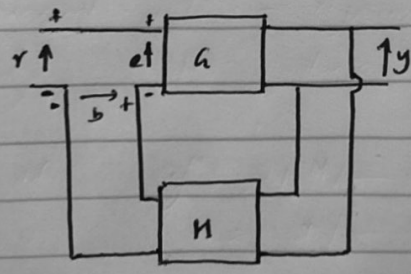
input - force on clutch pedal, changing gear lever position
output - change of gear, reduction of speed
system components - gear level, gear box, drive shaft, engine
clutch pedal, clutch pumps

Typing a paragraph and saving

input - Pressure on different keys and mouse input
output - Display the desired paragraph and saving as a file
System components - keyboard, mouse, Display, Processor, RAM

Recording a video
input - sound, image frames
output - video, and audio
System components - camera lens, microphone, storage

3.



i) $y = Ge$, $e = r - b$, $b = yH$

$\therefore \quad e = r - Hy$, $y = (r - Hy)G$

$$y = \frac{Gr}{1+GH}$$

$$\frac{y}{r} = M = \frac{G}{1+GH}$$

ii) $S_G^M = \dfrac{\partial M / M}{\partial G / G}$

$= \dfrac{\partial M}{\partial G} \cdot \dfrac{G}{M}$ $\qquad \dfrac{\partial M}{\partial G} = \dfrac{(1+GH) - GH}{(1+GH)^2}$ and $\dfrac{G}{M} = 1+GH$

$= \dfrac{1+GH}{(1+GH)^2} \qquad = \dfrac{1}{(1+GH)}$

$S_G^M = \dfrac{1}{1+GH}$

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(iii) $S_H^M = \dfrac{\partial M/M}{\partial H/H}$

$= \dfrac{\partial M}{\partial H} \cdot \dfrac{H}{M}$, $\dfrac{\partial M}{\partial H} = \dfrac{0 - G^2}{(1+GH)^2}$ and $\dfrac{H}{M} = \dfrac{(1+GH)H}{G}$

$= \dfrac{-G^2}{(1+GH)^2}$

$\therefore$

$S_H^M = \dfrac{-G^2}{(1+GH)^2} \times \dfrac{(1+GH)H}{G}$

$S_G^M = \dfrac{-GH}{(1+GH)}$