Basics of Control

Open Loop versus Closed Loop
and
PID

Definitions

Control System - Alters State of a System

Control Theory - A strategy to alter the inputs of the system in order to achieve desired outputs

Definitions

Plant - System to be controlled

Controller - mechanism that alters the System inputs

System Feedback
- Open Loop
- Closed Loop

Open Loop

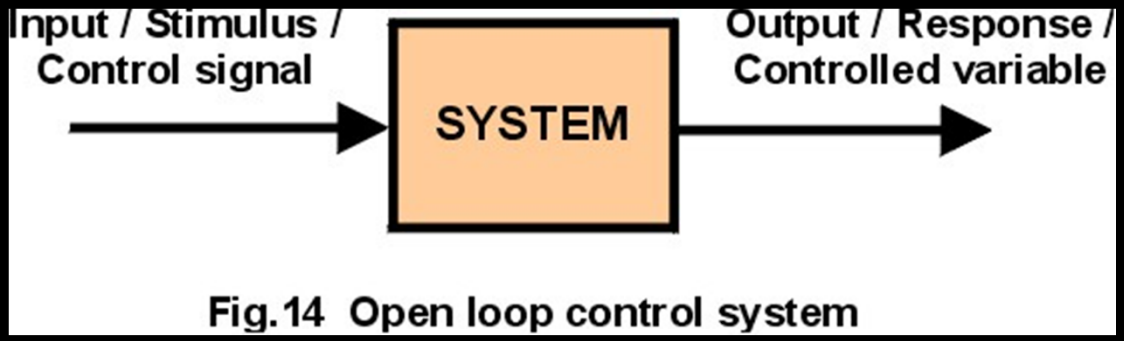
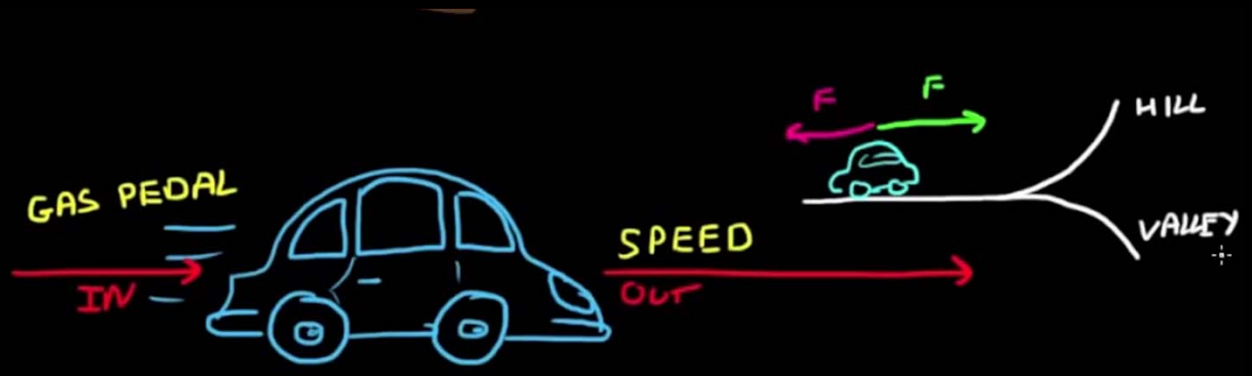
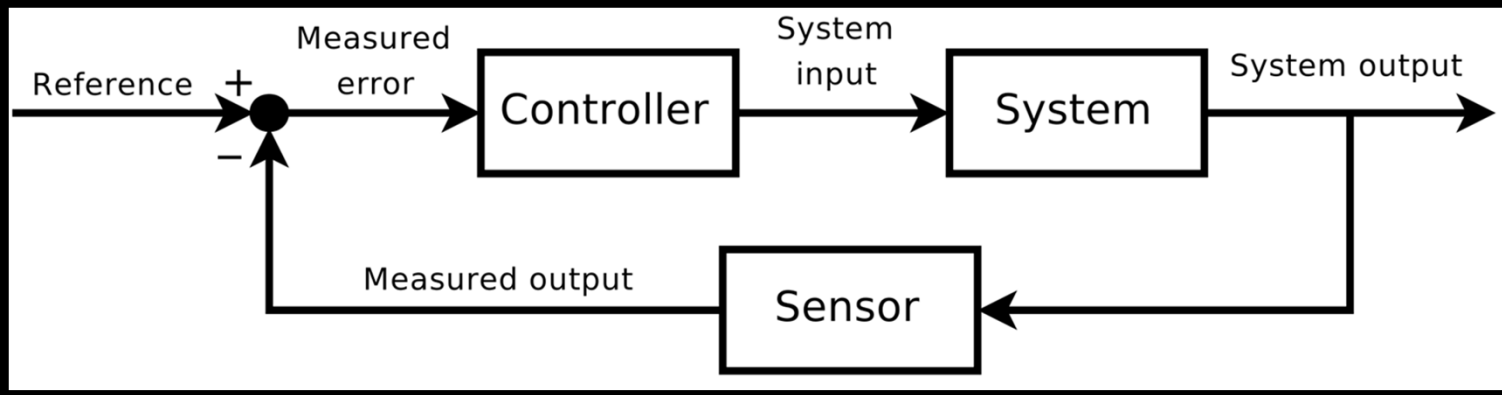


Fig.14 Open loop control system

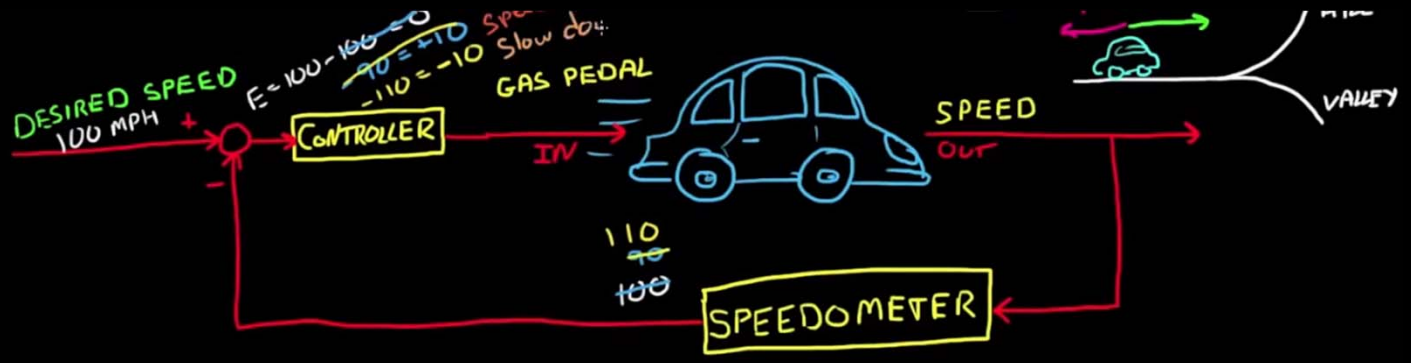
Open Loop Example



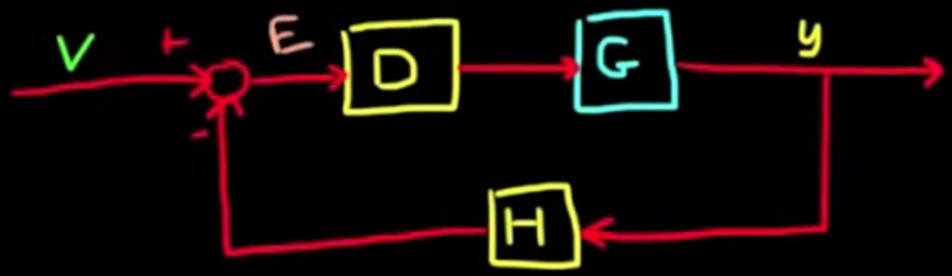
Closed Loop


Reference
+
−
Measured
error
Controller
System
input
System
System output
Measured output
Sensor

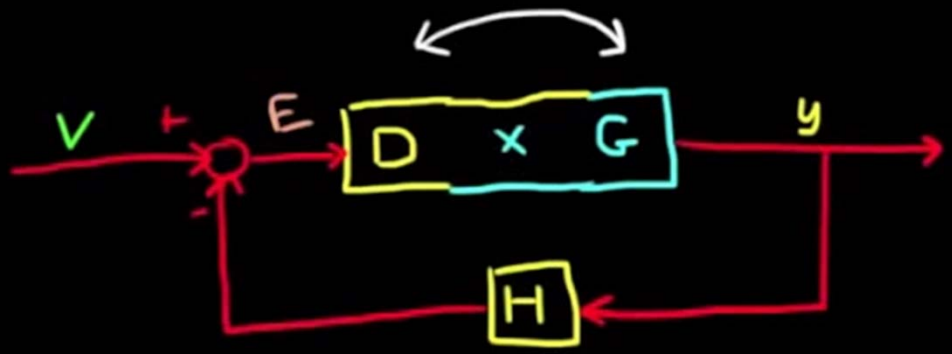
Example Closed Loop



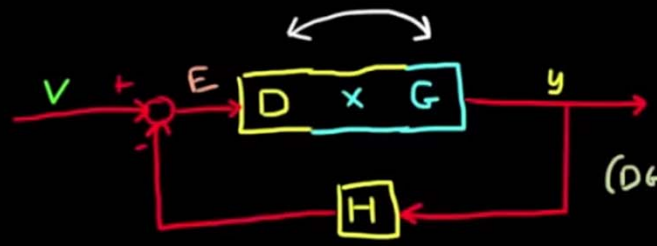
System Block Diagram



Simplify



Transfer Function



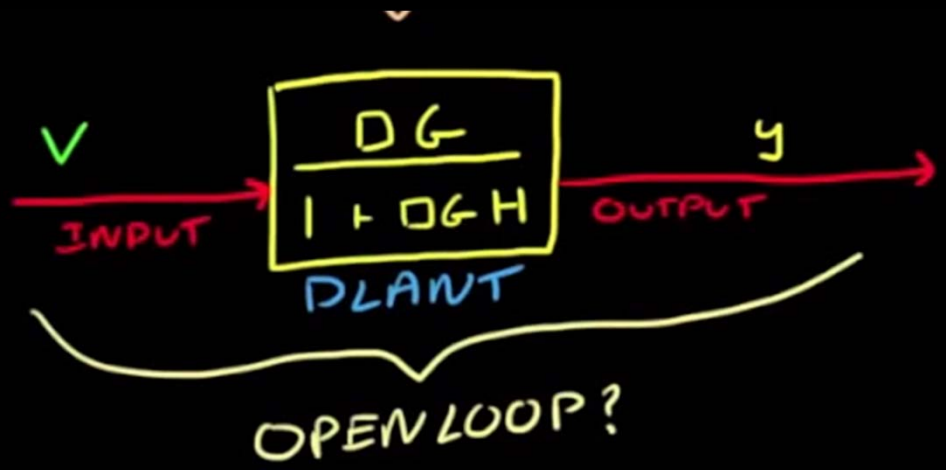
$$E = V - yH$$

$$y = E \cdot D \cdot G \Rightarrow E = \frac{y}{D \cdot G}$$

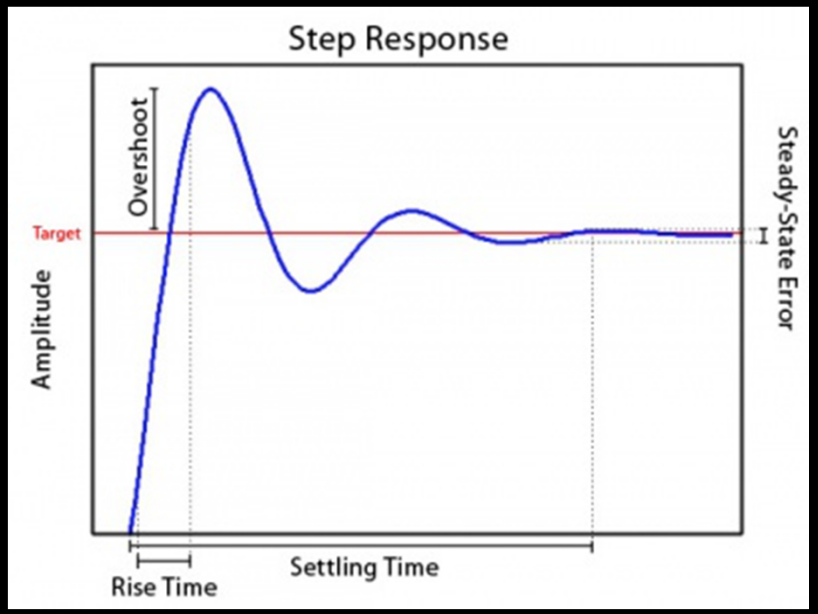
$$(DG)(V - yH) = \frac{y}{D \cdot G}$$

$$DGV = y(1 + DGH) \quad \text{or} \quad y = \frac{DG}{1 + DGH}$$

Transfer Function



Understanding the Plant - Step Response



PID Controller Ziegler-Nichols

Ziegler–Nichols method[1]			
Control Type	K_p	K_i	K_d
P	$0.5K_u$	-	-
PI	$0.45K_u$	$1.2K_p/T_u$	-
PD	$0.8K_u$	-	$K_pT_u/8$
classic PID[2]	$0.60K_u$	$2K_p/T_u$	$K_pT_u/8$
Pessen Integral Rule[2]	$0.7K_u$	$2.5K_p/T_u$	$3K_pT_u/20$
some overshoot[2]	$0.33K_u$	$2K_p/T_u$	$K_pT_u/3$
no overshoot[2]	$0.2K_u$	$2K_p/T_u$	$K_pT_u/3$

Just use youtube and wikipedia

https://www.youtube.com/watch?v=O-OqgFE9SD4&list=PLUMWjy5jgHK3j74Z5Tq6Tso1fSfVWZC8L

hint assignment 2 PID section read http://en.wikipedia.org/wiki/Ziegler%E2%80%93Nichols_method