EEC 157A

Control systems 12:10 — 1:30 pm

UC Davis. Fall 2010.

See webpage about information on course.

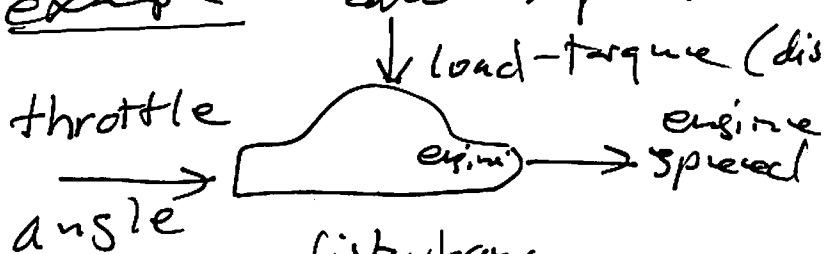
Notes are available on web.

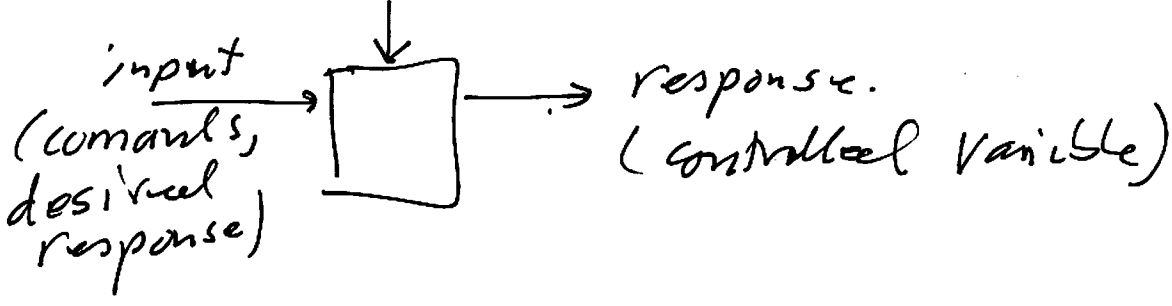
book on Reserve.

There is chat page!

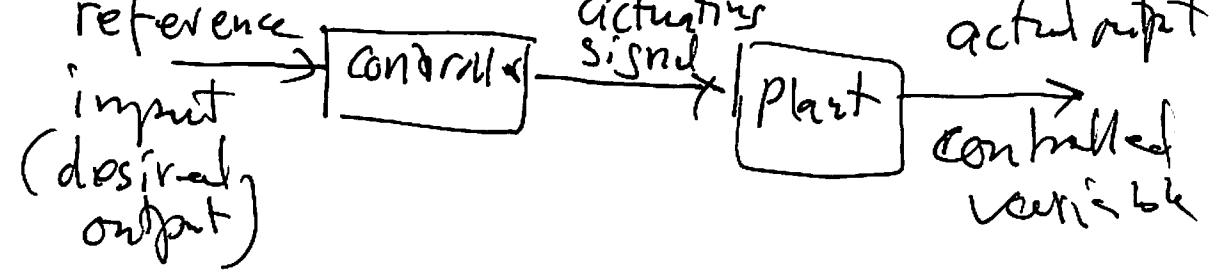
main component of control system is the plant. it is the part that can't need to be changed. but that we need to control its output.

example idle-speed control system



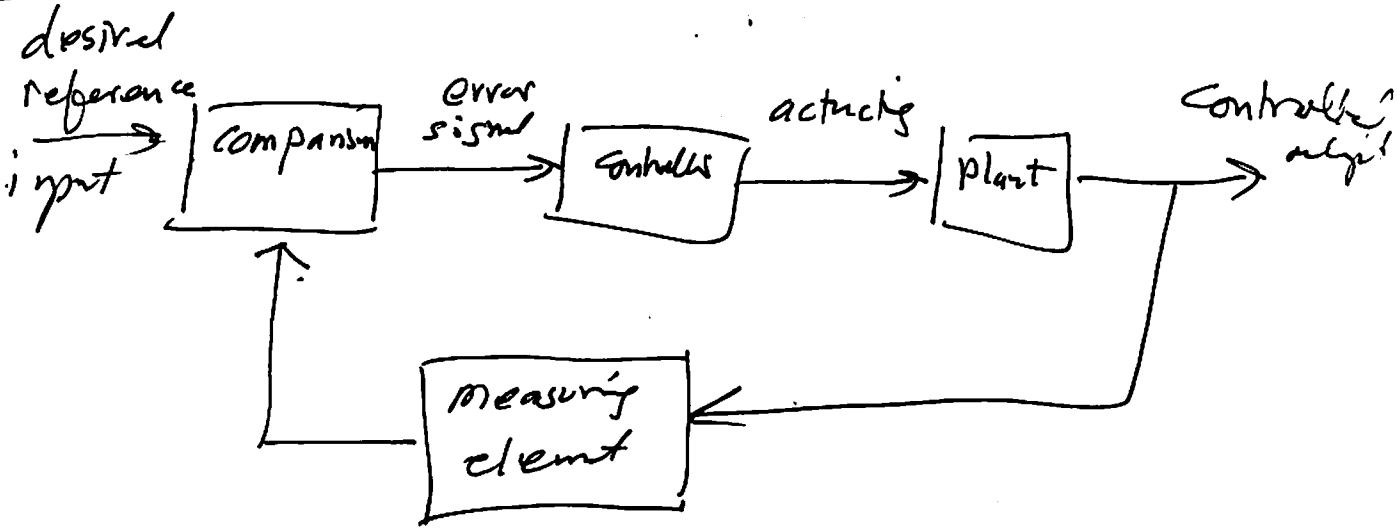


open loop



in openloop, output signal has no effect on control action.

Closed Loop



Can also be called regulator

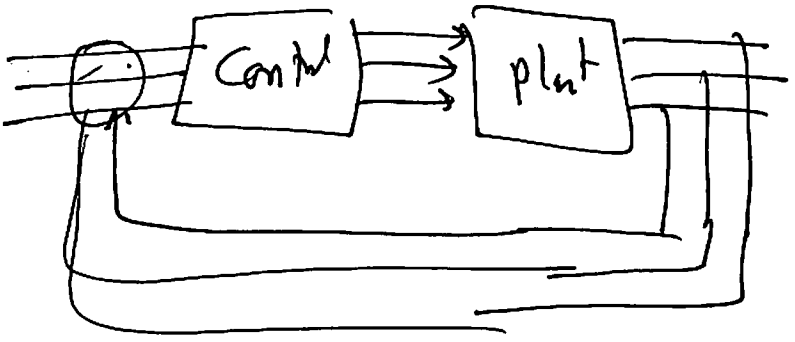
Example

sensor technology is improving, so should use more feedback.

to read signals:

in closed loop, change inside plant can be controlled.

in this course will talk about SISO.
we don't do MIMO



adaptive Control system.

Can handle changes in plant.
requires "identification".
i.e need to read plant parameters
all the time, and adjust
Controller to reflect new plant.

Robust Controller

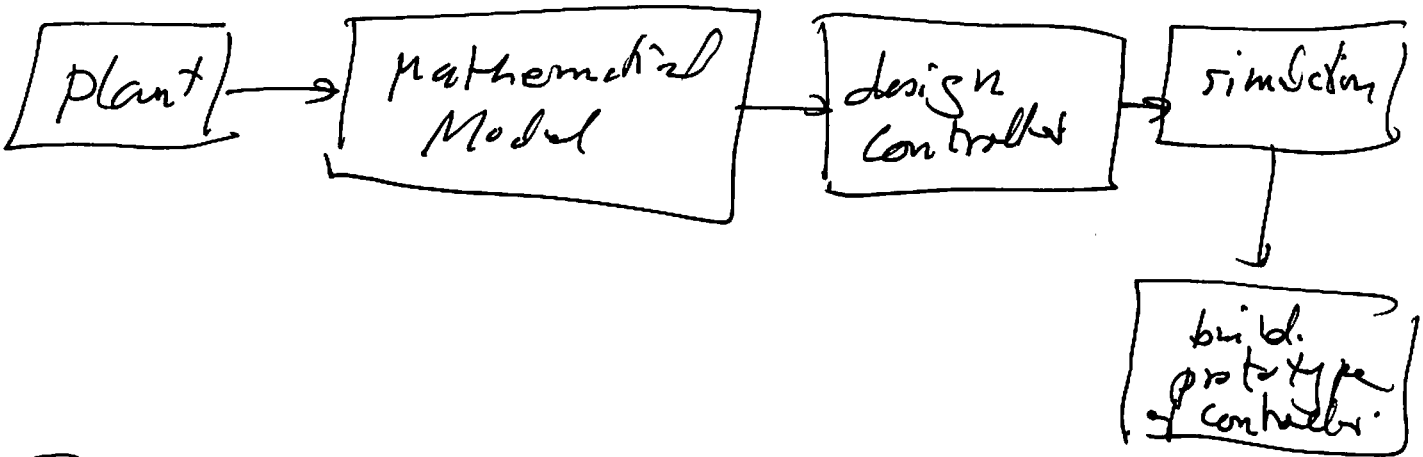
a single Controller to work with
a class of plants. i.e controller
small variations of plant.

150A is prerequisite

Objectives of Controller

- stable response of plant.
- small error in response relative to reference
- robust (sensitivity minimization to plant variations).
- reduce effect of disturbances.

steps to Control system design



Then hook prototype of Controller to plant.
if ok. done else repeat process.

Need Laplace transform.

Liner system:

$x_1 \longrightarrow \square \longrightarrow y_1$

$x_2 \longrightarrow \square \longrightarrow y_2$

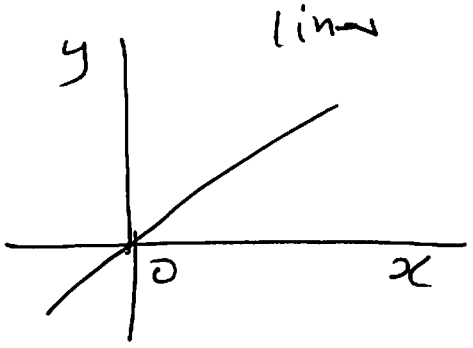
if system is liner then:

$x_1 + x_2 \longrightarrow \square \longrightarrow y_1 + y_2$

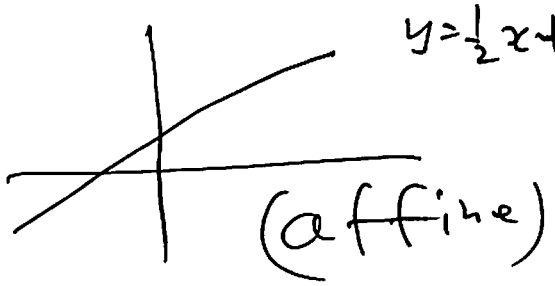
and $\alpha x_1 \longrightarrow \square \longrightarrow \alpha y_1$

so $\alpha = 0$ means, ~~$0 \cdot y_1 = 0$~~ output is $0 \cdot y = 0$.

so for liner system, it must go through origin.



but

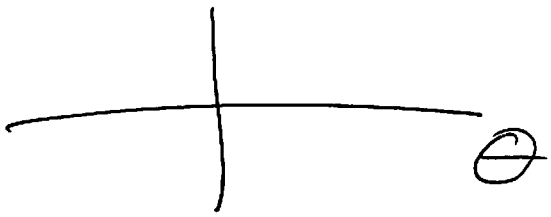


called affine

Non liner system.

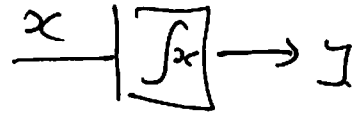
even though equation is liner

Cosθ.



not linear.

$\frac{dx}{dt}$ is linear.



$\int x(t)dt$. is linear.

practice linear system.

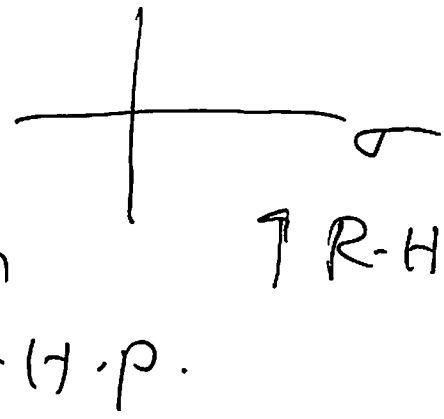
we assume we are working around the plant nominal stable point so behavior is approximated to linear.

in this course we will work with:

Linear, time invariant, Lumped system. SISO.

complex variables..

$S = \sigma + j\omega$



if we exclude the j-ω axis, we call it

open R.H.P ⇒ open L.H.P.

if Numerator degree ≤ denominator degree

the G(s) is called proper Transfer

function.

strictly proper Transfer function is

one that has Num degree < den degree.

Non proper Transfer functions are

not physically realizable.