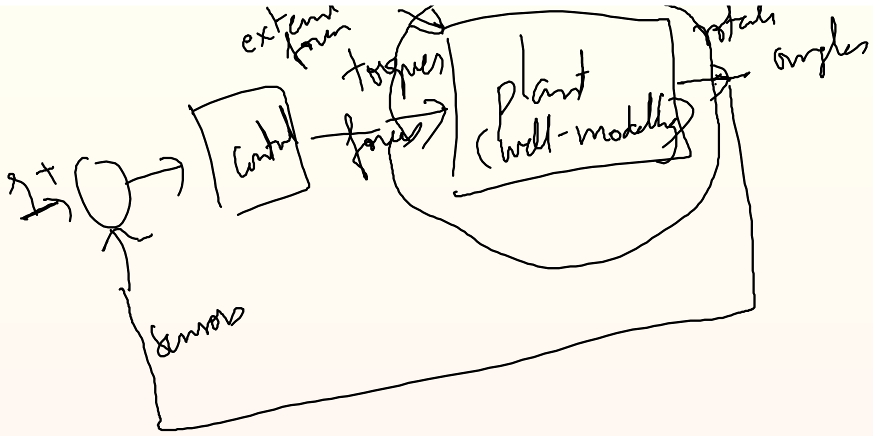
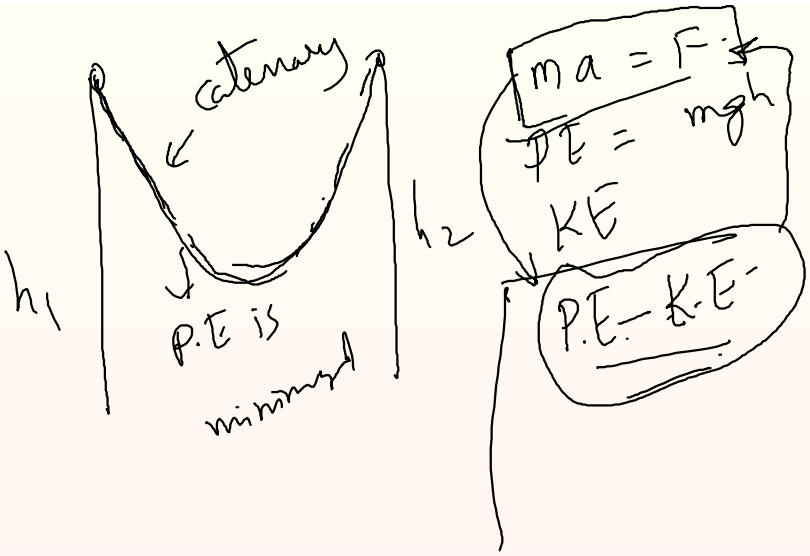
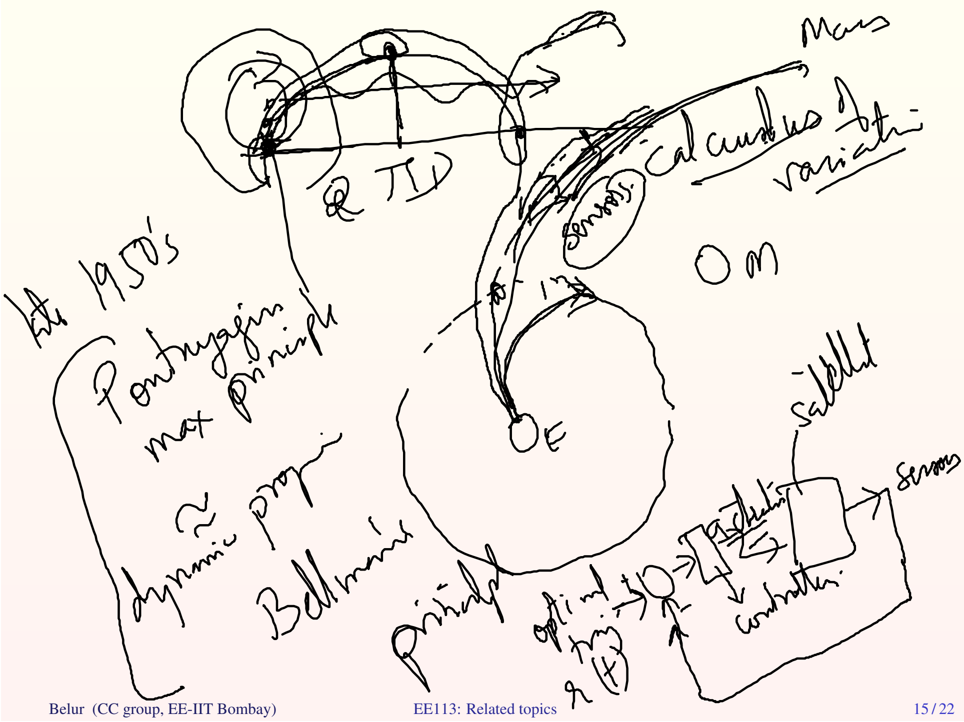
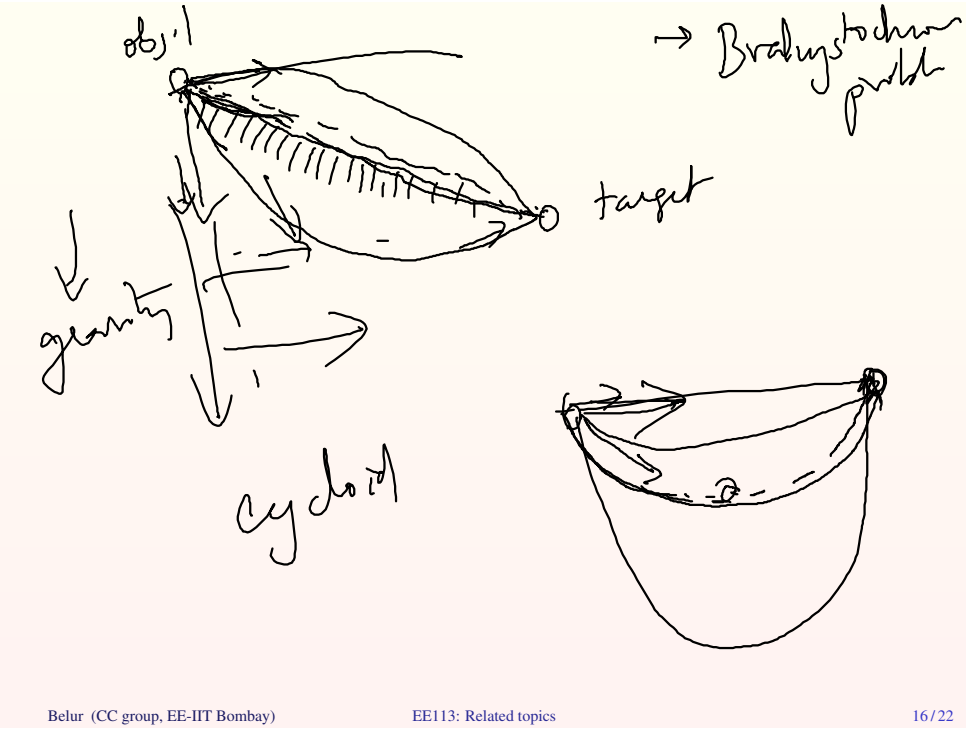
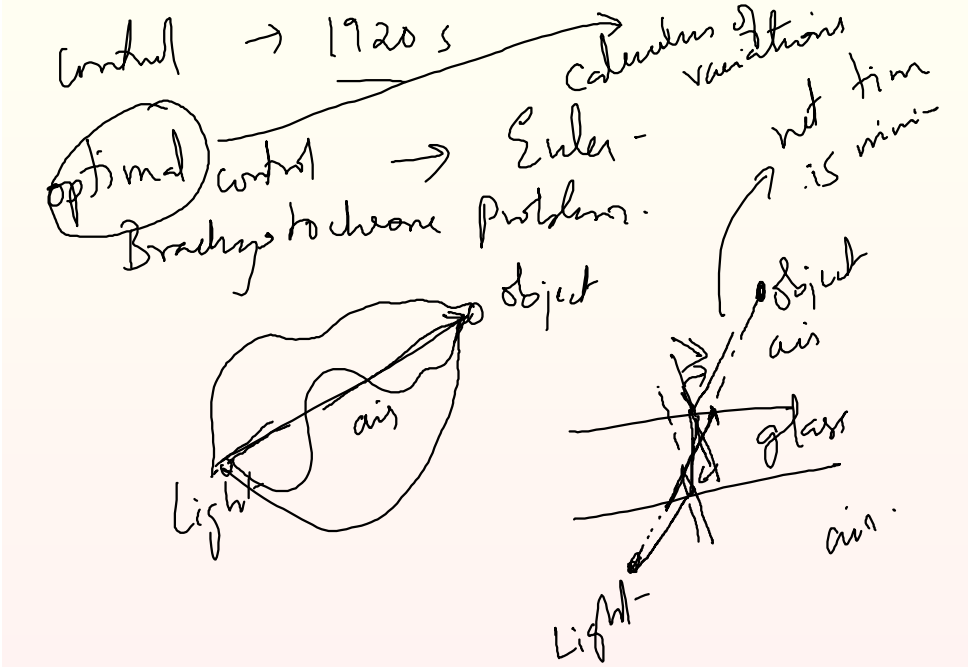


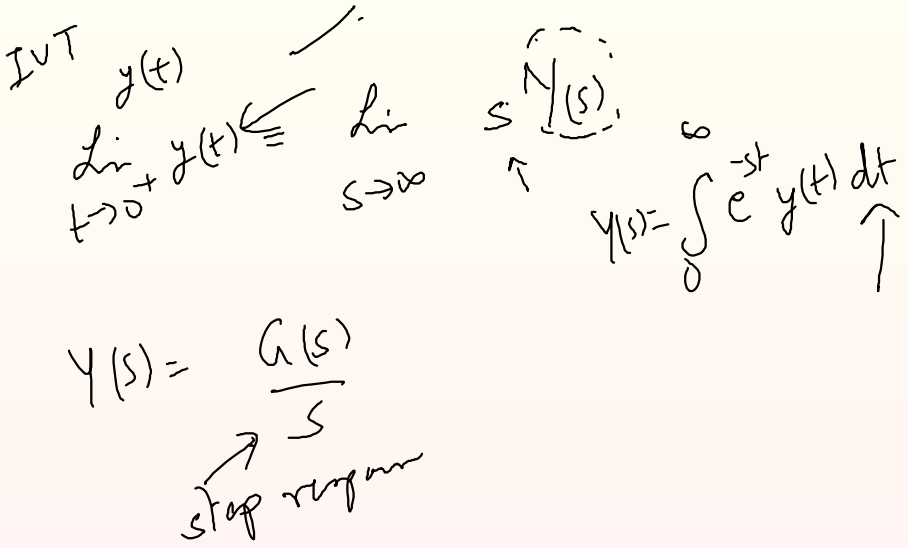
r
+
control
torques
forces
external forces
plant
(well-modelling)
rotations
angles
sensors


catenary
h_1
h_2
P.E is
minimum
$ma = F$
$PE = mgh$
KE
P.E = K.E

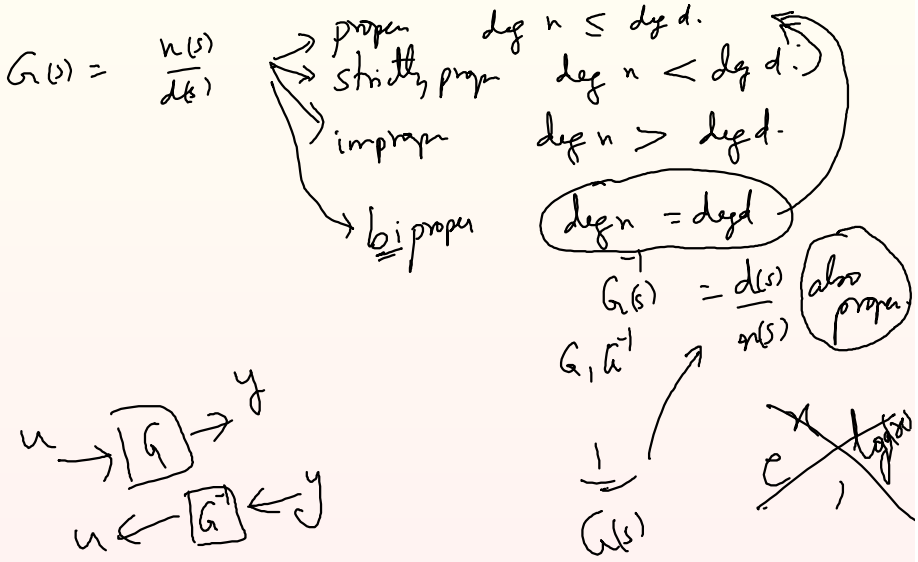

Mars
calculus of variations
Pontryagin's
max principle
dynamic programming
Bellman's
principle
Om
satellite
controller
sensors
E

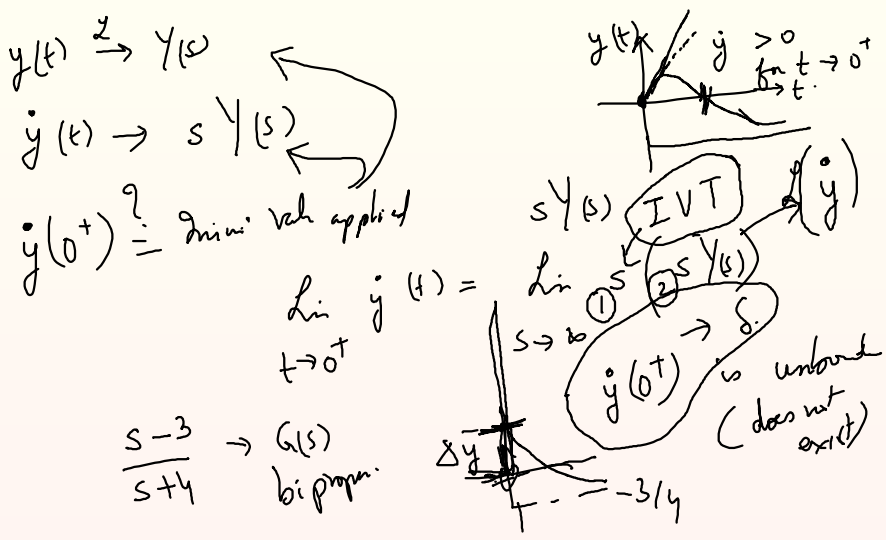

obj. 1
→ Brakystochrone
target
gravity
cycloid

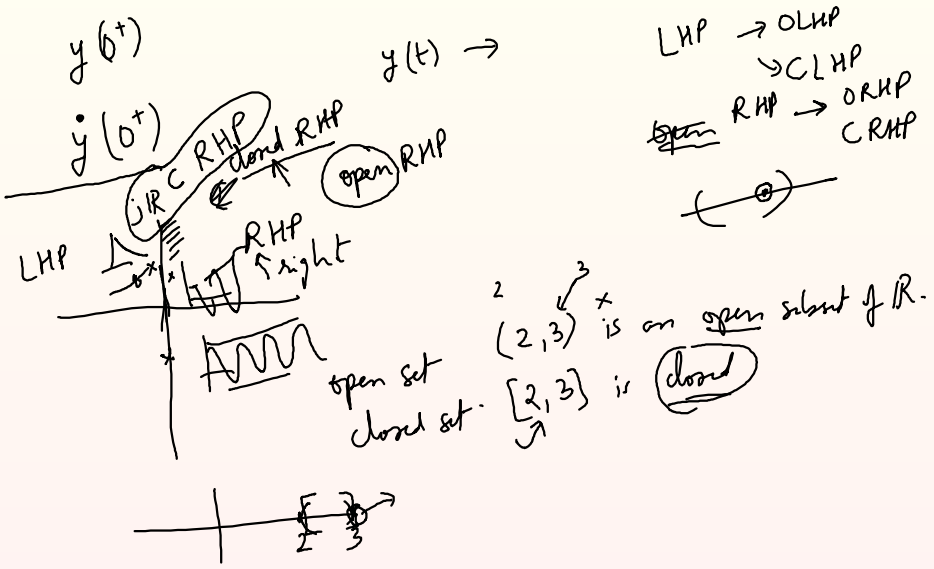

Control → 1920s
calculus of variations
optimal control → Euler-
Brachys to chrone problem.
net time is mini-
object
air
Light
object
air
glass
air
Light


IVT
y(t)
$\lim_{t\to 0^+} y(t) \Leftarrow \lim_{s\to\infty}$
$sY(s)$
$Y(s) = \int_0^\infty e^{-st} y(t)\,dt$
$Y(s) = \frac{G(s)}{s}$
step response

Hairy ball theorem




$y(t) \xrightarrow{\mathcal{L}} Y(s)$
$\dot{y}(t) \rightarrow sY(s)$
$\dot{y}(0^+) \stackrel{?}{=}$ limit value applied
$\lim_{t \to 0^+} \dot{y}(t) = \lim_{s \to \infty}$
$\frac{s-3}{s+4} \rightarrow G(s)$ bi prop.
$y(t)$
$\dot{y} > 0$ for $t \to 0^+$
t
$sY(s)$
IVT
$y(\dot{y})$
$sY(s)$
$\dot{y}(0^+) \rightarrow \infty$
is unbound (does not exist)
Δy
$-3/4$


y(0+)
ẏ(0+)
y(t) →
jR
C RHP
closed RHP
open RHP
LHP
RHP
right
open set
closed set.
LHP → OLHP
↘CLHP
RHP → ORHP
CRHP
(2,3) is an open subset of R.
[2,3] is closed
2
3

Tutorial on Thursday: will send problems today