Project : 1

Name: Gaurav Lavadiya
ASUID: 1222768924

- for the given conditions

- Gravity_acceration = 0-12
- Boost_acceration = 0-18

- drag = $CD * A * \rho \times \frac{1}{2} \times V^2$

- Assumed values for drag calculation

- Cd = 0.25
- A = 10 (Crossection area of rocket)
- ρ = density = 0.00179
- V = velocity in y direction

⇒ rocket parameters
→ mass = 549054 kg
→ diameter = 3.7m
→ Area = 10.75 ≈ 10 taken for simplysity
→ volume = 752.64706
- ρ = mass / volume

→ X ⇒ X-coordinates
y ⇒ y-coordinates

V_x ⇒ velocity in x direction
V_y ⇒ velocity in y direction

→ objective function:

$$\min_{\theta} \| S(T)^2 \|$$

where $S(T) = (x(T), V_x(T), y(T), V_y(T), \theta)$

→ constraints

$$x(t+1) = x(t) + V_x(t) \cdot \Delta t$$
$$y(t+1) = y(t) + V_y(t) \cdot \Delta t$$

→ $V_x(t+1) = V_x(t) + \Delta t \cdot g \cdot \cos\theta(t)$
$V_y(t+1) = V_y(t) + \Delta t \cdot \sin\theta(t)$

⇒ $drag = -\frac{1}{2} \cdot C_d \cdot A \cdot \rho \cdot V_y^2$

⇒ state = state + delta_state_gravity + ~~delta~~ ...
delta_state_theta - drag

$$Step.mat = \begin{bmatrix} 1 & \Delta t & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & \Delta t & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ V_x \\ V_y \\ \theta \end{bmatrix}$$

- the optimizer is set to run 30 iterations for T=100s

⇒ conclutions

→ from value of loss and graph of convergence we can say that at the end of 30 iteration loss converges to zero.

→ also, for x at the iteration go by it also approaches to zero.