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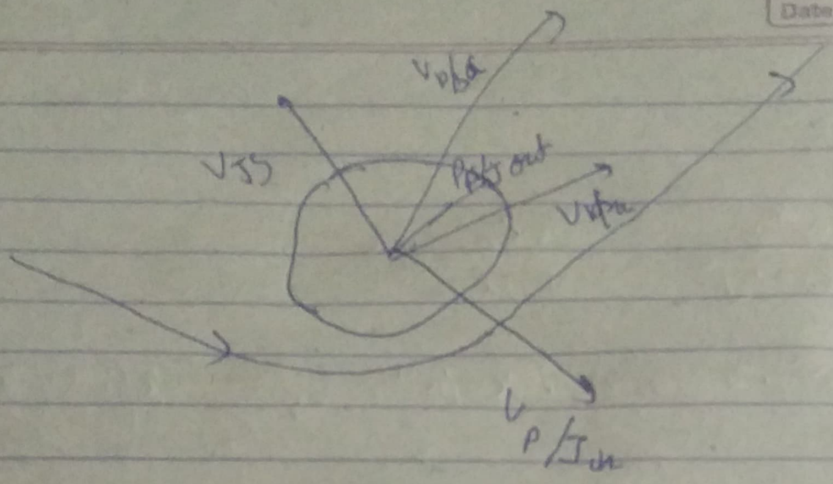


Initially $V_{p/J}$ was in ~~dire~~ another direction but when it comes to range of Jupiter's gravity It changes it's speed as well as direction

So here we can apply momentum conserved b/w satellite and Jupiter and also energy con since only gravity is acting here.

& Here $\vec{V}_{new} = \vec{V}_{p/s\,in} + \vec{V}_{J/S}$

$$|\vec{V}_{new}| - |\vec{V}_0| = \text{(16 km/s)}$$

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colab.research.google.com/drive/1XsBXfBhUR8z6WVc4loPbYb55IgEjQwne?hl=en#scrollTo=6TvX5se5RgfF

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```
            child_chromosome=self.gene//10+self.gene%10
        elif prob < 0.80 :
            child_chromosome=par2.gene//10+par2.gene%10
        else:
            return Individual(self.mutated_genes())
        return Individual(child_chromosome)


generation = 1

found = False
population = []

# g=Genes(random.randint(0,95),random.randint(0,5))
# create initial population
for _ in range(POPULATION_SIZE):
            gnome = Individual.create_gnome()
            population.append(Individual(gnome))
# print(type([population[0]]))
while not found:

    population = sorted(population, key = lambda x : x.fitness, reverse=False)

    if population[0].fitness ==-100 :
        found = True
        break

    new_generation = []

    s = int((10*POPULATION_SIZE)/100)
    new_generation.extend(population[:s])

    s = int((90*POPULATION_SIZE)/100)
    for _ in range(s):
        parent1 = random.choice(population[:50])
        parent2 = random.choice(population[:50])
        child = parent1.mate(parent2)
        new_generation.append(child)

    population = new_generation


    print("Generation: {}\tSkill: {}\tLuck: {}\tFitness: {}".\
    format(generation,(population[0].gene//10),population[0].gene%10,
```

0s

print("hello world").py - Visual Studi... | [Python 3.6.8 Shell] | geneticalgo2.py - /users/me/bt/eesh

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for $L_3$

$$\frac{G M_s}{(x+r)^2} - \frac{G M_e}{(x-r_1)^2} = \frac{G(M_s+M_e)}{(r_1+r_2)^3} x \quad -③$$

$L_3 = -1.5000187 \times 10^{11}$ $\quad L_3 = -R\left(1+\frac{5}{12}\right.$

Substituting $L_3$ in eq ③

eq ⑤ $= 0$

$\Rightarrow$ $L_3$ satisfies eq$^n$ 3 $\quad -R\left(1+\frac{5 M_2}{12}\right.$

Putting

giving $L_1 = R\left(1+\left(\frac{m_E/m_S}{3}\right)^{1/3}\right)$

Putting $L$, $m_E$, $m_S$, $R$ in eq$^n$ 1 and checking whether $L_1$ satisfies eq$^n$ 1 or not

$L_1 = \cancel{1.5}\ 1.515 \times 10^{11}$ km

putting it in eq$^n$ 1

eq$^n$ 1 $= 0$

$\Rightarrow$ $L_1$ satisfies eq$^n$ 1

Similarly for $L_2$

eq$^n$ 2

$$\frac{GM_S}{(x-x_1)^2} + \frac{GM_E}{(x+x_2)^2} - \frac{G(M_S+M_E)}{R^3}x = 0$$

$$\Rightarrow M_S(x+x_2)^2 R^3 + GM_E(x-x_1)^2 R^3 = (M_S+M_E)x(x-$$

for $L_2 = 1.48 \times 10^{11}$ km $\quad L_2 = \left(1-\left(\frac{M_E}{3M_S}\right)^{1/3}\right)R$

putting $L_2$ in eq$^n$ 2

$\cancel{L_2}$ eq$^n$ 2 $= 0$

$\Rightarrow$ $L_2$ satisfies eq$^n$ 2

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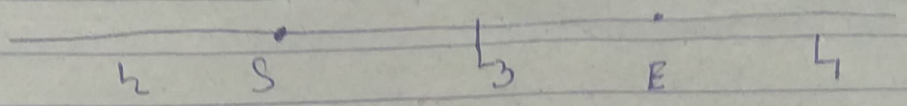
~~Q2 For point $L_1$~~



∴ for an ~~equitpo~~ equipotential region
$V =$ constant

$\Rightarrow \frac{dV}{dr} = 0 \Rightarrow F = 0$

$\Rightarrow (F_G)_S + (F_G)_E =$ $F_{\text{centrifugal force}} = F_c$

For L1 region

$$\frac{GM_s}{(x+r_1)^2} + \frac{GM_e}{(x-r_2)^2} = \frac{G(M_1+M_2)}{(R_{SE}^3)} \times x$$

$r_1 =$ Distance of sun from COM $= \frac{M_e R}{M_e+M_s}$

$r_2 =$ Distance of earth from COM $= \frac{M_s R}{M_s+M_e}$

~~Putting the value of $M_e$, $M_s$ and R~~

$$GM_s(x-r_2)^2 R^3 + GM_e(x+r_1)^2 R^3 = G(M_1+M_2)x(x\ldots$$

$$\Rightarrow M_s(x-r_2)^2 + M_e(x+r_1)^2 R^3 = (M_s+M_e)x\ldots$$

0

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$$\Rightarrow \Delta v_2 = \sqrt{\frac{GM}{r}}\left(1 - \sqrt{\frac{2r}{r_1+r}}\right)$$

$$\Delta v_{total} = \Delta v_1 + \Delta v_2$$

$$\Rightarrow = \sqrt{\frac{GM}{r_1}}\left(\sqrt{\frac{2r_2}{r_1+r_2}} - 1\right) + \sqrt{\frac{GM}{r}}\left(1 - \sqrt{\frac{2r_1}{r_1+r_2}}\right)$$

On putting ~~tat~~ ~~ti~~ value for transfer b/w geostationary orbit ~~of~~ and graveyard orbit

$r_1 = \cancel{360}\ 35800 + R_e = 42200$ Km

$r_2 = \cancel{36050+}\ 36050 + R_e = 42450$ Km

$$\Rightarrow (\Delta v_{total})_{gy} = \Delta v_1 + \Delta v_2 = 9.07 \text{ m/s}$$

Similarly on putting values for transfer b/w geostationary orbit and Low earth orbit

$r_1 = 35800 + R_e = 42200$

$r_2 = 400 + R_e = 6700$

$$(\Delta v_{total})_{LEO} = \Delta v_1 + \Delta v_2 = -3856 \text{ m/s}$$

$$\because (\Delta v_{total})_{gv} > (\Delta v_{total})_{LEO}$$

$\Rightarrow$ we would prefer transfer to graveyard orbit.

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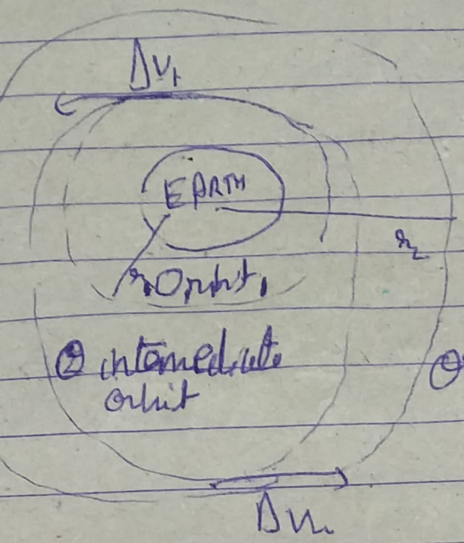


Transferring from orbit-1 to intermediate orbit

$$\frac{-GM_em}{2r_1} + \frac{1}{2}mv^2 = \frac{-GM_em}{r_1+r_2}$$

$$\Rightarrow 2\left(\frac{GM_e}{2r_1} - \frac{GM_e}{r_1+r_2}\right) = v^2$$

$$\sqrt{\frac{2GM_e}{r_1}}\cdot\sqrt{\frac{r_2}{r_1+r_2}} = V_1$$

$$\Rightarrow \Delta v_1 = \sqrt{\frac{GM_e}{r_1}}\left(\sqrt{\frac{2r_2}{r_1+r_2}} - 1\right)$$

For transforming from ~~orbit~~ intermediate orbit to orbit

$$\frac{-GM_em}{r_1+r_2} + \frac{1}{2}mv^2 = \frac{-GM_em}{2r_2}$$

$$\Rightarrow v_2^2 = 2\sqrt{\frac{GMe}{r_2}}\left(\ldots\right.$$