Projeto 3 – Space Shuttle

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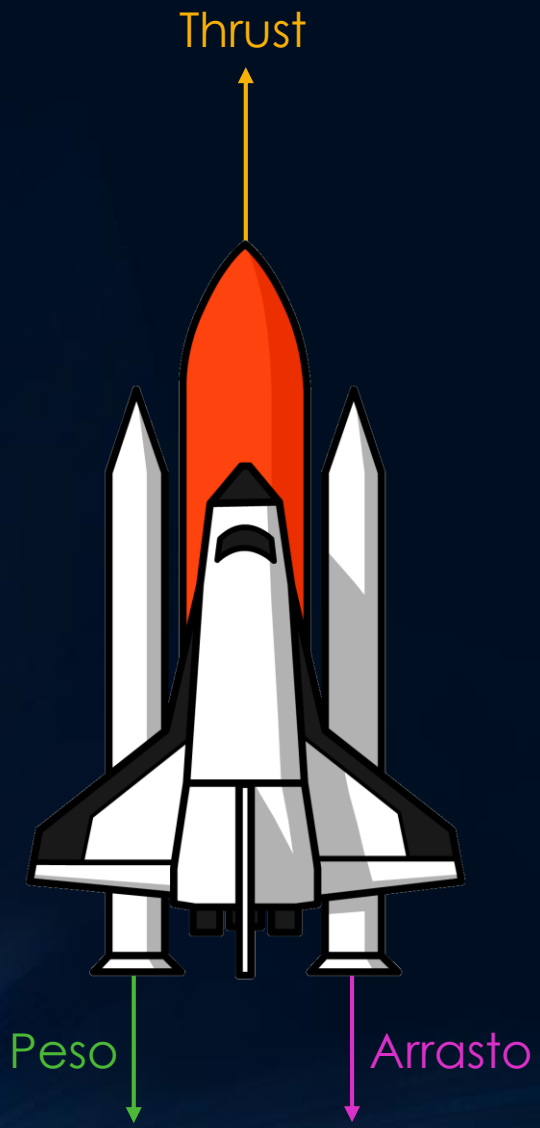
Com quais velocidades de vento o Space Shuttle permanece em órbita?

Diagramas de Forças



Equações Diferenciais e Parâmetros

Fase 3:

$$\frac{dx}{dt} = V_x$$

$$\frac{dV_x}{dt} = -\left(\frac{G \cdot m_{terra} \cdot x}{\sqrt{(x^2 + y^2)^3}}\right)$$

$$\frac{dy}{dt} = V_y$$

$$\frac{dV_y}{dt} = -\left(\frac{G \cdot m_{terra} \cdot y}{\sqrt{(x^2 + y^2)^3}}\right)$$

$Ve_1 = 2817.0\ \frac{m}{s}$ *Velocidade de Saída do Exaustor booster*

$Ve_2 = 3636.0\ \frac{m}{s}$ *Velocidade de Saída do Exaustor orbiter*

$mvar_1 = 8369.0\ \frac{kg}{s}$ *Fluxo de combustivel boosters*

$mvar_2 = 1378.0\ \frac{kg}{s}$ *Fluxo de combustivel orbiter*

$M_0 = 2034681.0\ kg$ *Massa Inicial*

$g = 9.78\ \frac{m}{s^2}$ *Gravidade*

$r = 1.225\ \frac{kg}{m^3}$ *Densidade do Ar*

$A = 408\ m^2$ *Área do Corpo*

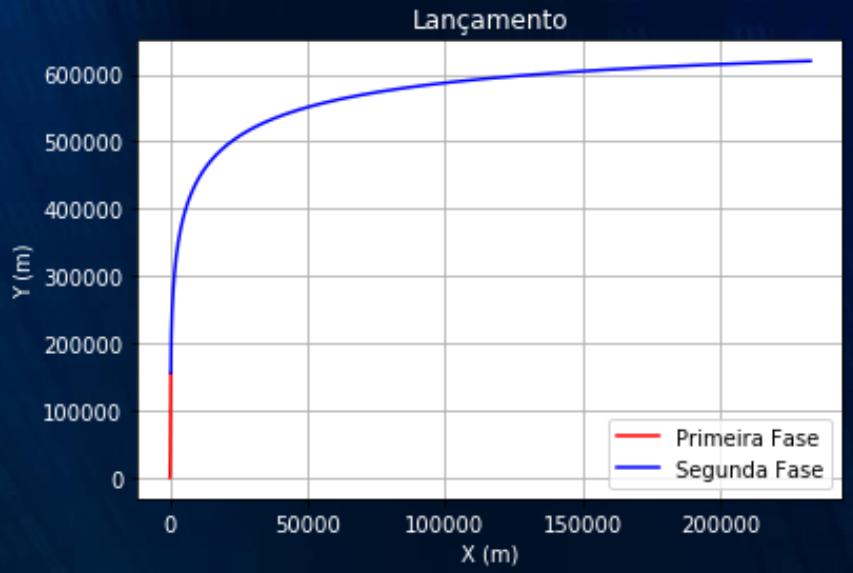
$Cd = 0.061$ *Coeficiente de Drag*

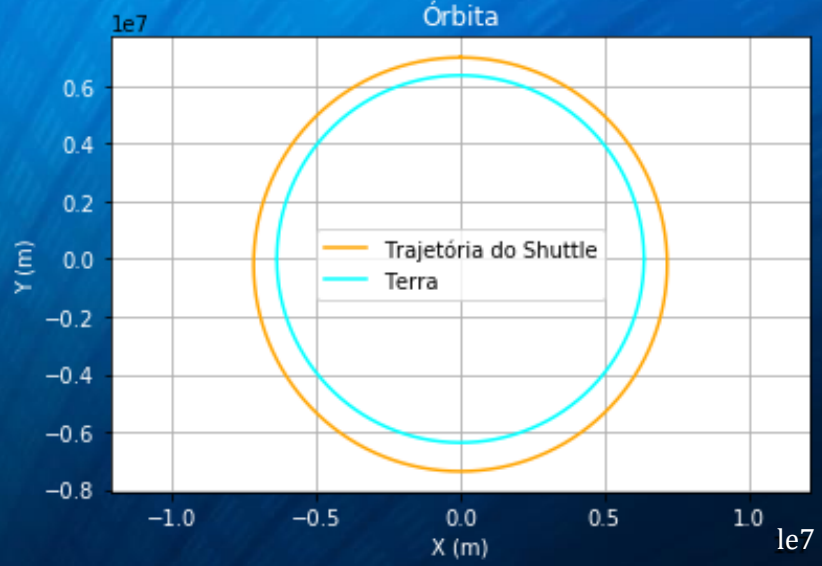
$G = 6.67 \cdot 10^{-11}\ \frac{m^3}{kg \cdot s^2}$ *Constante de Gravitação Universal*

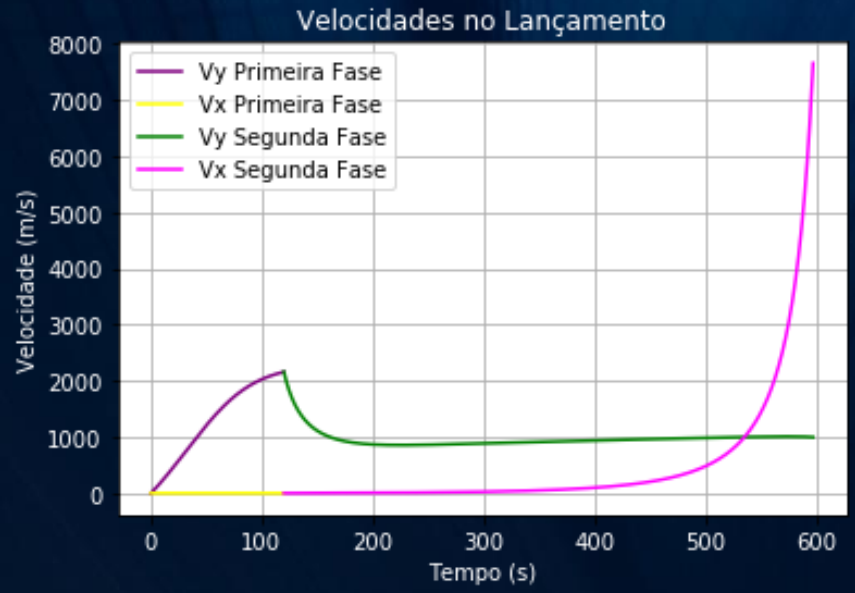
$m_{terra} = 5.972 \cdot 10^{24}\ kg$ *Massa da Terra*

$r_{terra} = 6371\ km$ *Raio da Terra*

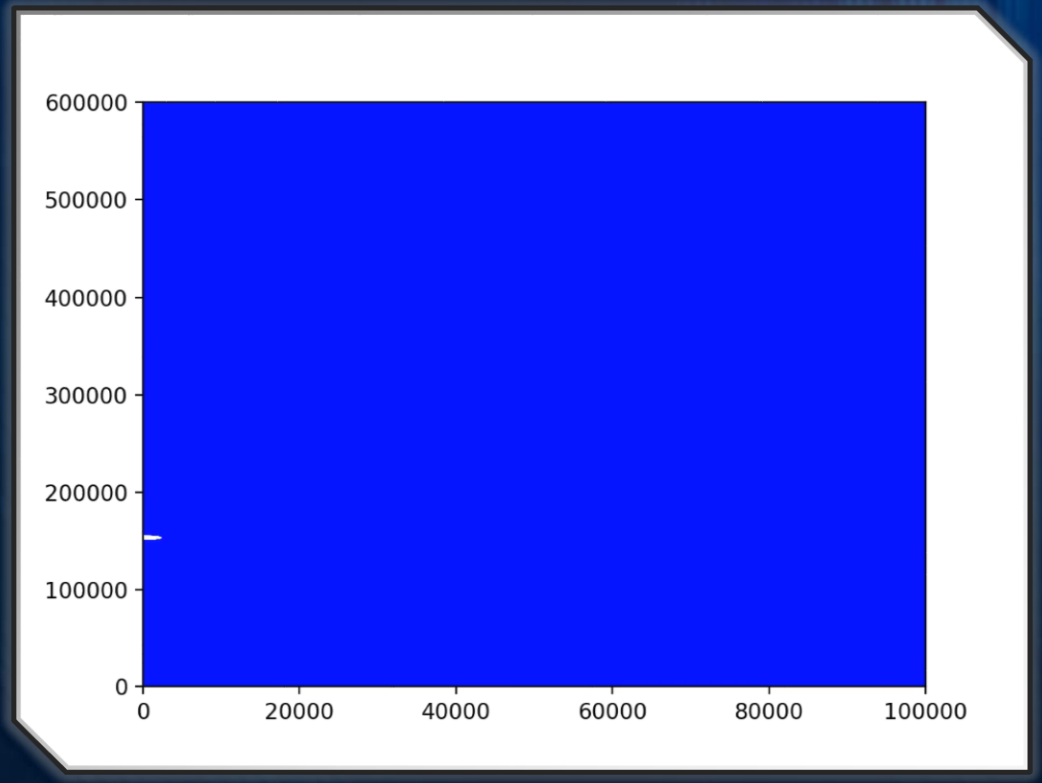
Implementação dos Sistemas

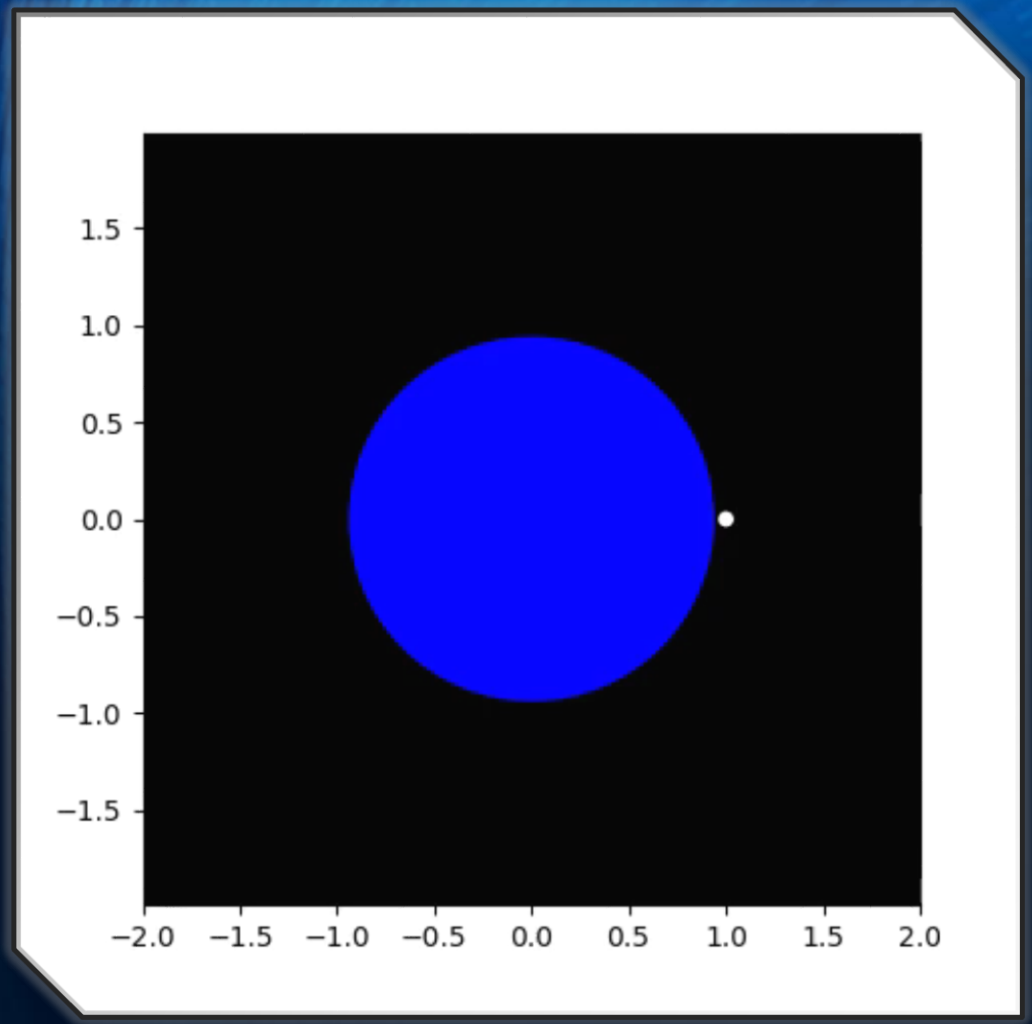




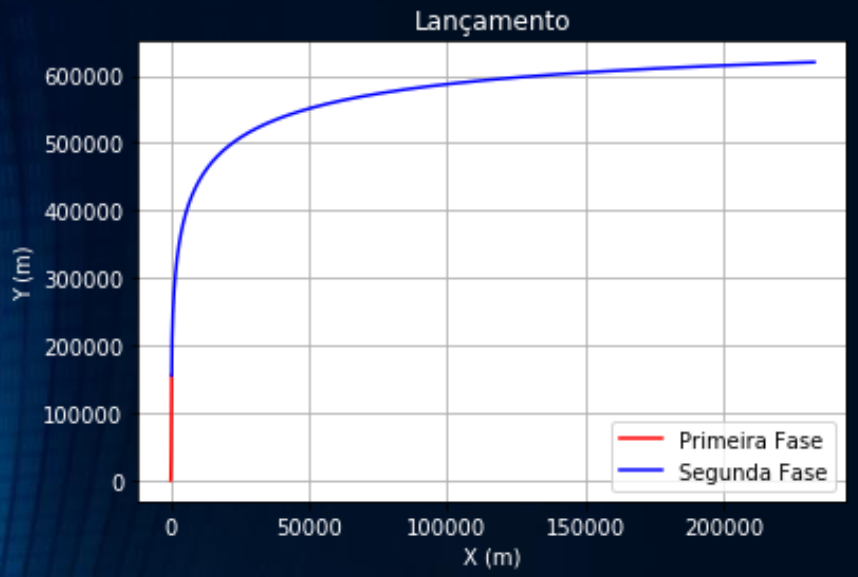


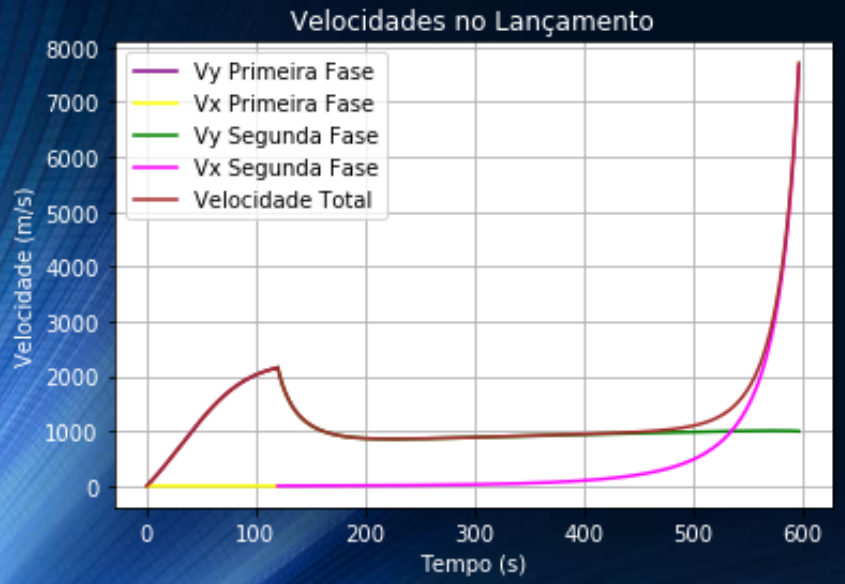
Animações

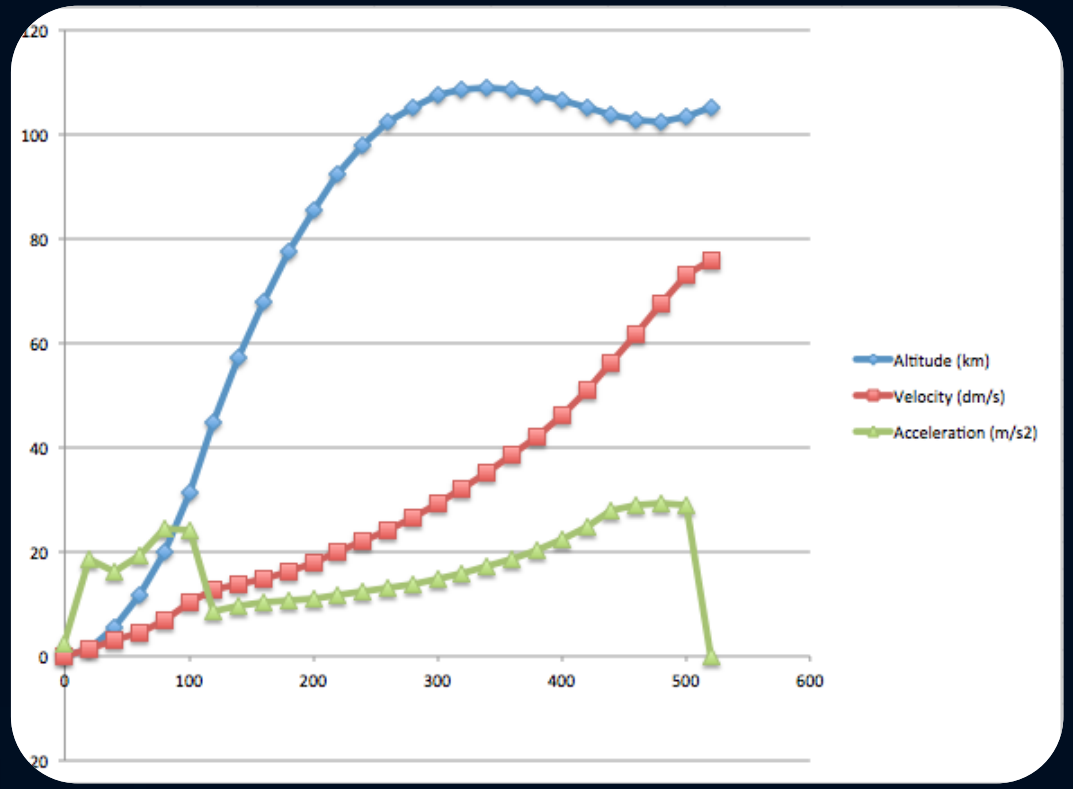

600000
500000
400000
300000
200000
100000
0
0
20000
40000
60000
80000
100000


1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0

Validação dos Sistemas







Fonte: http://ct-stem.northwestern.edu/curriculum/preview/20/

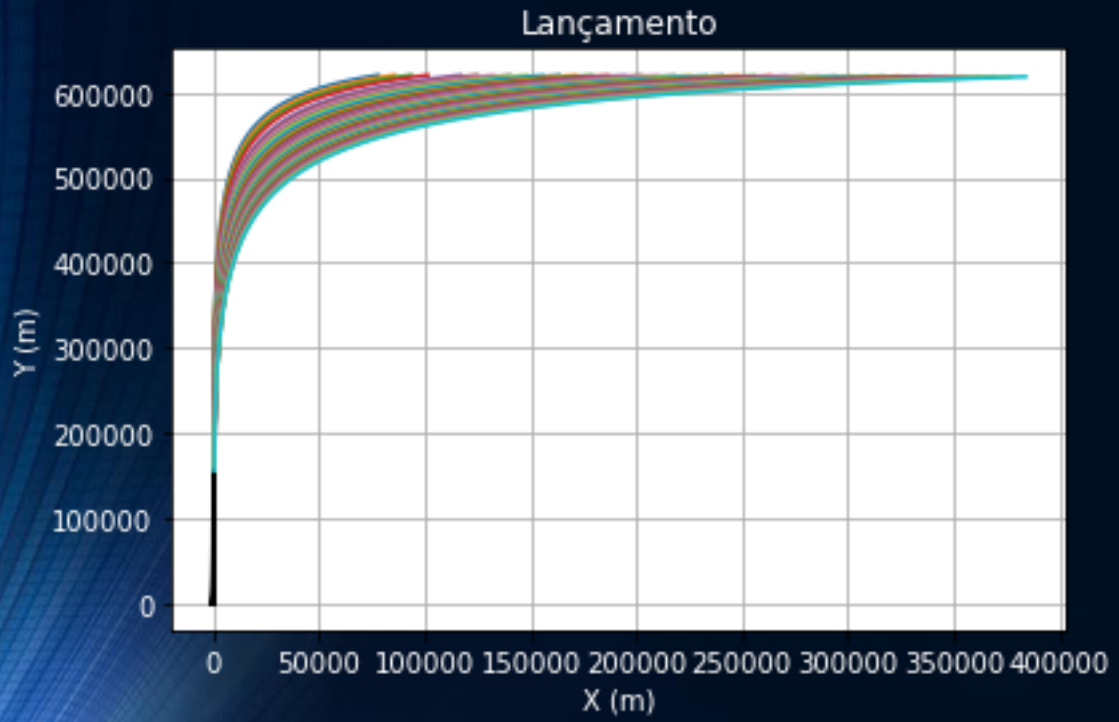
Cletus from Bithlo

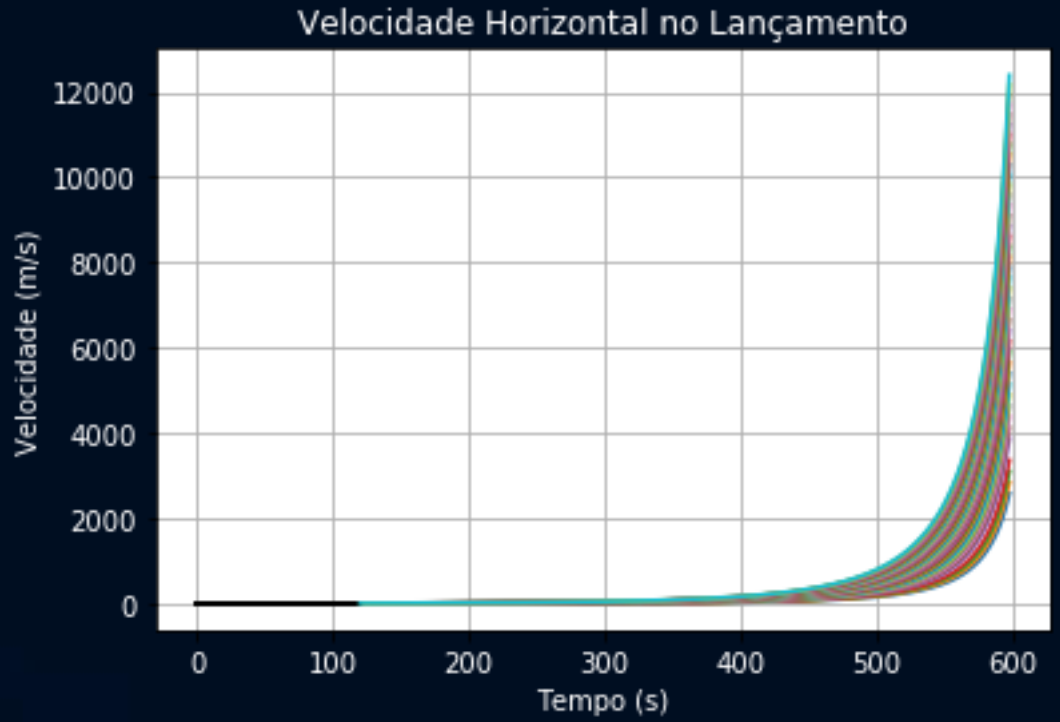
How long does it take the shuttle to orbit the Earth once?

It takes approximately 90 minutes for the orbiter to go around the Earth one time, moving at 17,500 miles per hour.

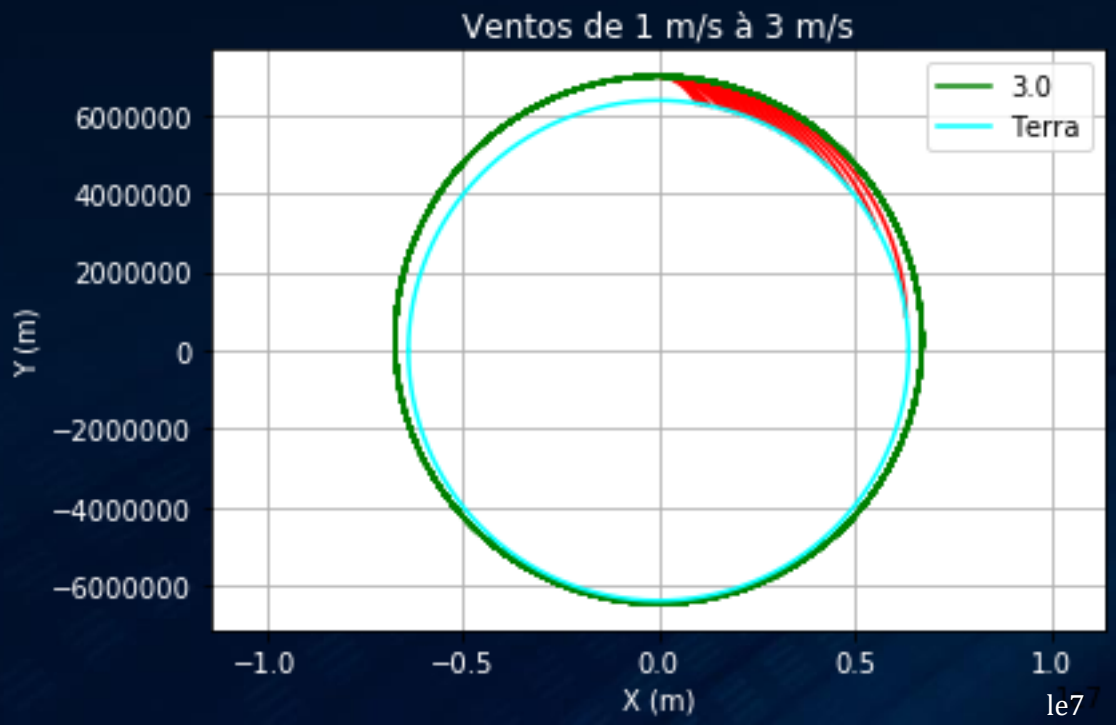
Fonte:https://www.nasa.gov/missions/highlights/webcasts/shuttle/sts113/processing-qa.html

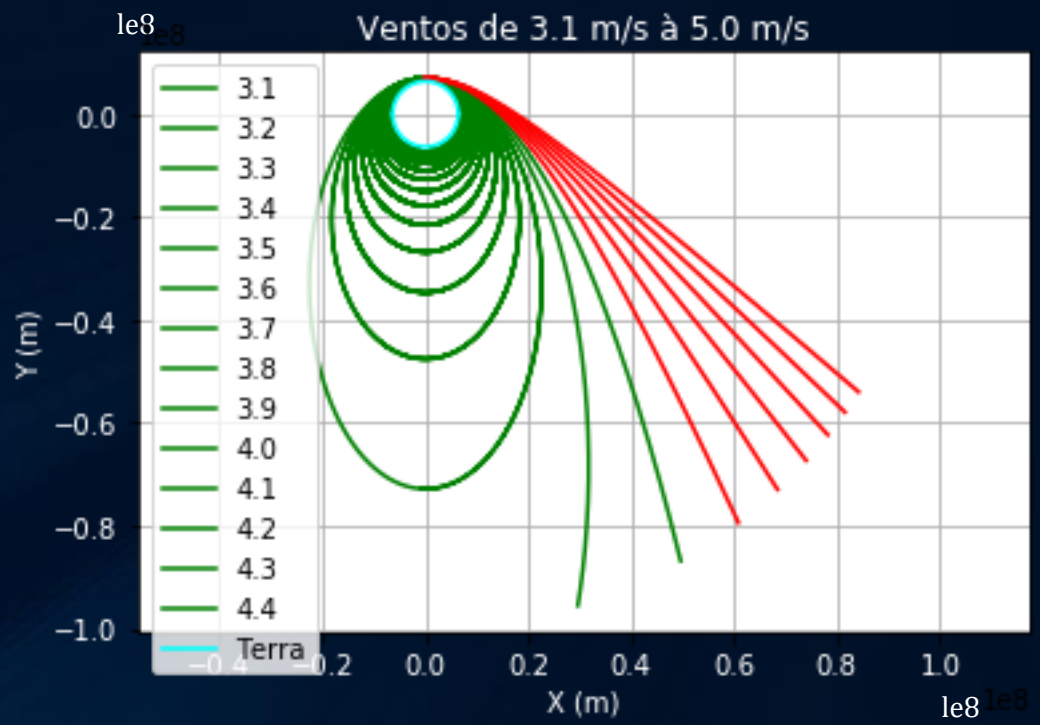
Análises de Sensibilidade





Gráficos Conclusivos





O Shuttle permanece em órbita com os ventos de 3.0 ➡ 4.4 $\frac{m}{s}$

FIM