PHYS338:Computational Physics HW6

Student Name: Hamza AlHasan-1181636

Submission Date: Nov 2, 2020

The two differential equations that describe the Felix model are:

$$\begin{aligned}\frac{dv}{dt} =& F_g - F_d \\ =& \frac{g}{(1+\frac{h}{R_e})^2} - \frac{1}{2}\frac{A}{m}C(v)\rho(h)v^2 \\ \frac{dh}{dt} =& -v\end{aligned}$$

where F_g is the gravitational force, and F_d is the drag force in opposite direction, and $C(v)$ and $\rho(h)$ as shown in the question.

I used Forward Euler method to solve these equations with $\Delta t = 0.1$:

$$\begin{aligned}h_{i+1} =& h_i + \Delta t * \frac{dh}{dt} \\ v_{i+1} =& v_i + \Delta t * \frac{dv}{dt}\end{aligned}$$

The terminal velocity results from this code is $= 3.827332 * 10^2$ m/s. And the time needed to reach the ground is $= 1.696 * 10^2$ s. This value can be gotten from the last value in plot data (h VS t).

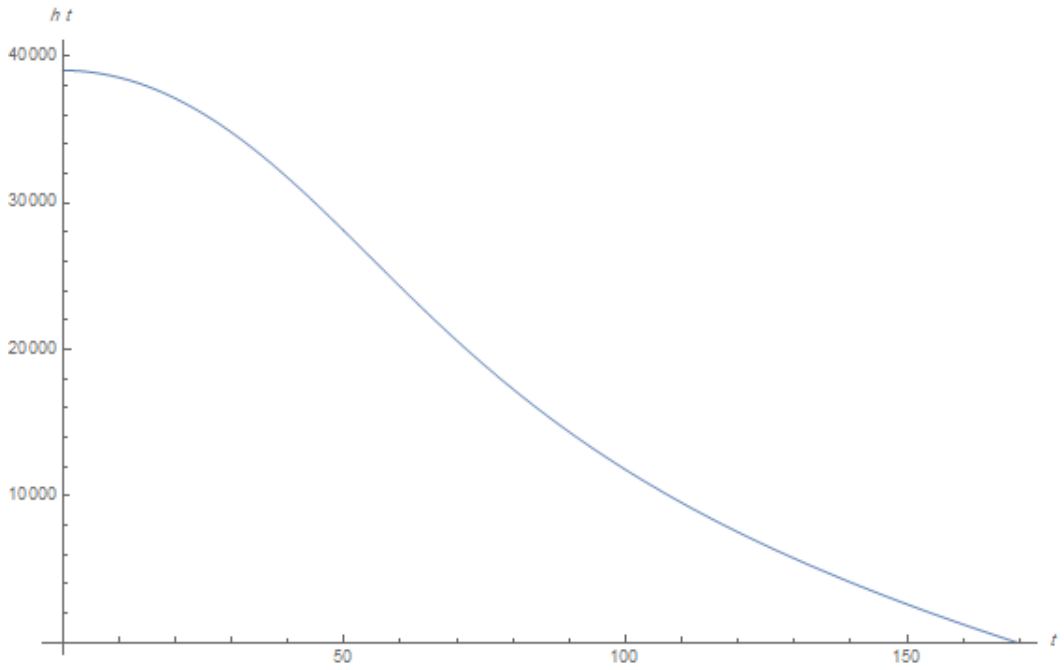

Figure 1: h(t) VS t

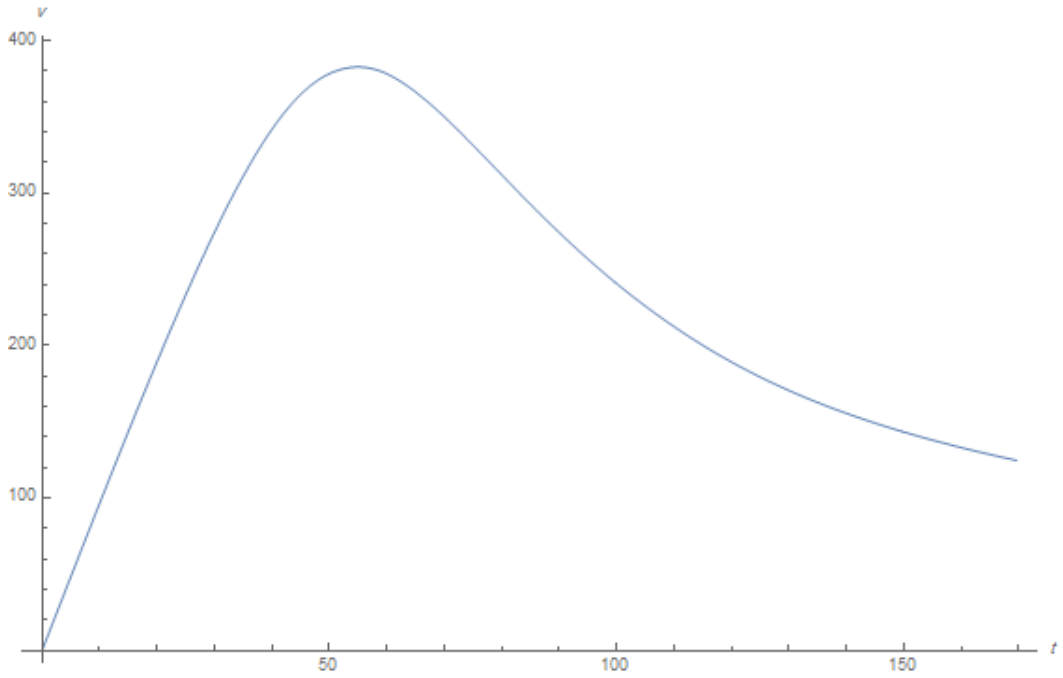

Figure 2: v(t) VS t

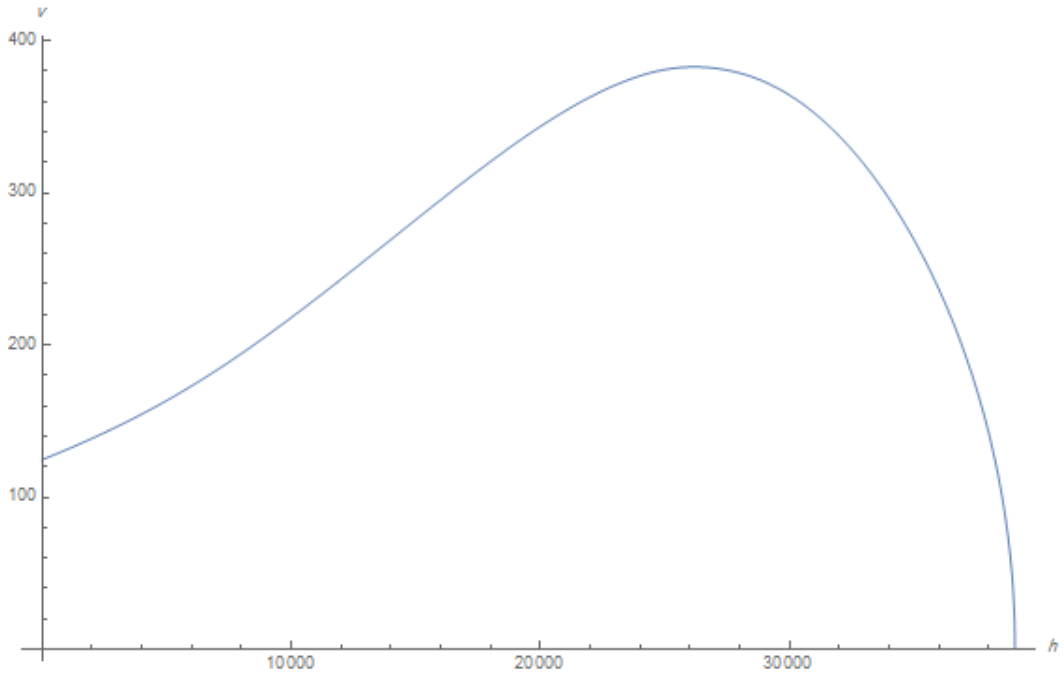

Figure 3: v(t) VS h(t)