Omojola Temiloluwa Oluwatomisin
17/ENG07/1058
Electrical /Electronics Engineering
EEE 382 Assignment 1

A flat plate of mass m falling freely in air with velocity v is subject to a downward gravitational force and an upward frictional drag force due to air. If the drag force, F_D is given by equation as

$$F_D = \frac{0.3v^2}{500 + (4v)^3} - 0.02v \quad \text{---(1)}$$

and the terminal velocity is reached when the drag force equals the gravitational force, that is $F_D = mg$

Taking the values of m to be 35kg and g to be $9.8 m/s^2$ using a guess value of $V_0 = 0.5$ and employing fixed point iteration method, develop a MATLAB program without any function command to estimate the terminal velocity. Take the absolute percentage relative error to be less than or equal to $1E-11$

Solution

```
commandwindow
clear
clc
format short
v=0.5
m=35
g=9.8
F=m*g
V=sqrt(((((F+(0.02*v))*(log(v)^3))+(10*v)+17150/0.3);
for i=1:inf
if Ea(i+1)=1
v(i+1)=sqrt(((((F+(0.02*v(i)))*(log(v(i))^3)+(10*v(i)+17150/0.3);
Ea(i+1)=abs(((v(i+1)-v(i))/v(i+1))*100);
if Ea(i+1)<=1E-11
break
end
end
table=table(i',v',Ea')
```

itr	v	f_3
0	0.5	
1	237.05	99.771
2	29447	18.736
3	302.61	2.7897
4	303.85	0.40972
5	304.04	0.60144
6	304.07	0.0088222
7	304.07	0.00125741
8	304.07	0.00018781
9	304.07	$2.7842e^{-05}$
10	304.07	$4.0835e^{-06}$
11	304.07	$8.7765e-09$
12	304.07	$1.2888e-08$
13	304.07	$.1.8709e-07$
14	304.07	$2.1727e^{-10}$
15	304.07	$4.0679e^{-11}$

converging at itr = 7 , v = 304.07

$F_D = \frac{0.3v^2}{500+(1+v)^3} - 0.02v$

$F_D = 9.8 \times 3.5 = 34.30$

substituting v into F_D

$F_D = \frac{0.3 \times (304.07)^2}{500+(1+304.07)^3} - 0.02(304.07)$

$F_D = 40.38195731 - 6.0814$

$F_D = 34.3$