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16/Eng06/007
Mechanical
ENG 382
Assignment 1

A plate (flat) of mass is falling freely in air with velocity(v) is subjected to a downwards gravitational force, fd is given by eqn (1)

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

and the terminal velocity is reached when the drag force equals the gravitational force, that is, $F_D = Mg$ ---(2) taking the values of m and g to be 3.5kg and $9.8 m/s^2$ respectively, using a guess value of $V_0 = 0.5 m/s$ and employing, fixed point iteration method, develop a MatLAB program to estimate the terminal velocity. Take the absolute percentage relative error tolerance to be less than or equal to of

Sol

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

$$F_D = Mg = 3.5 \times 9.8 = 34.3 \quad \text{---(2)}$$

evaluating eqn (1) and (2)

$$Mg = 34.3 = \frac{0.3v^2}{500+(\ln v)^3} - 0.02v$$

Make v subject of formula

$$34.3 + 0.02v = \frac{0.3v^2}{500+(\ln v)^3}$$

$$0.3v^2 = (34.3 + 0.02v) * (500 + (\ln v)^3)$$

$$v^2 = [(34.3 + 0.02v) * (500 + (\ln v)^3)] / 0.3$$

$$v = \sqrt{[(34.3 + 0.02v) * (500 + (\ln v)^3)] / 0.3}$$

Initial guess value $\Rightarrow V_0 = 0.5 m/s$

Absolute % relative error, $Ea(T+1) \leq 1E$

MATLAB

```
1- Command window
2- clear
3- clc
4- close all
5- Format short g
6- Syms V
7- V = 0.5
8- for i =
9-   iter(i+1) = i;
10-  V(i+1) = [(34.3+(0.02*V(i))*[500+(log(V(i)]^
                0.3^0.5;
11-  Ea(i+1) = abs[V(i+1) - V(i)]/V(i+1) * 100;
12-  If Ea(i+1) < = 1E - - 11
13-   break
14-   End
15-  End
     table = [iter' V' Ea']
```

The estimated terminal velocity is 304.07m

Substituting in equ(11) $f_0 = 343$