

Hany Franklyn

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Chemical Engineering

Assignment 1

A plate of mass m falling freely in air with velocity V is subjected to a downward gravitational force and an upward frictional drag due to air. If the drag force F_D is given by eqn

$$F_D = \frac{0.3V^2}{500 + [\ln V]^3}$$

and the terminal velocity is reached when the drag force equals the gravitational force i.e. $F_D = mg$ --- (2) Taking the values of m and g to be 3.5 kg and 9.8 m/s^2 respectively, using a guess value of $V = 0.5 \text{ m/s}$ employing fixed point iteration method, develop matlab program to estimate the terminal velocity. Take the absolute percentage relative error to be less than or equal to 10^{-11}

sln

$$F_D = \frac{0.3V^2}{500 + [\ln V]^3}$$

$$F_D = mg = 3.5 \times 9.8 = 34.3$$

$$mg = 34.3 = \frac{0.3V^2}{500 + [\ln V]^3} = 0.02V$$

$$34.3 + 0.02V = \frac{0.3V^2}{500 + [\ln V]^3}$$

$$0.3V^2 = \frac{(34.3 + 0.02V) \times (500 + [\ln V]^3)}{0.3}$$

$$V = \sqrt{\frac{(34.3 + 0.02V) \times (500 + [\ln V]^3) + 10/3}{1}}$$