

EM215: Numerical Methods

Lab Assignment 1



Consider the problem of falling body given in page 2 of your lecture note. Refer to exercises 1.1 (d) and 1.2 (c) in pages 4 – 5 as well. Starting with the following mathematical model for the above problem, derive necessary solutions and answer the given questions.

$$\frac{dv}{dt} = g - \frac{c}{m}v$$

- (a) Instead of the velocity at time $t = 0$, if it is assumed that the velocity at some time $t = t_x$ was known as $v = v_x$, derive the analytical solution for the velocity, v .
- (b) If $t_x = 10 \text{ s}$ and $v_x = 44.87 \text{ m/s}$, derive a numerical scheme (similar to the one given in page 3) to calculate velocities of the body from time $t = 0 - 10 \text{ s}$.
- (c) Using the analytical solution you derived in part (a) above, show graphically, the variation of velocity of the body for $t = 0 - 10 \text{ s}$. Use black colour for the graph.
- (d) Use computer to solve the numerical scheme in part (b) above to give the velocity of the body for $t = 0 - 10 \text{ s}$. Use red colour for the graph, and plot it on the same axes as those of (c).
- (e) Discuss the possible reasons for any discrepancies of the two solutions (numerical (c) and analytical (d)).

Submit your solutions as a short report. You may use either Matlab or Python for parts (c), (d). Give your codes as an appendix.