GA_5: Roots

ME 273 | Fall Semester 2017

Project Exercises

For the exercises below, perform the requested calculations, include documented code used in presenting your solution, and clearly display numerical results. Where appropriate or requested, add a detailed explanantion of your results.

Exercise 1 The velocity v of a falling parachutist is given by

$$v = \frac{mg}{c}\left[1 - \exp\left(-\frac{c}{m}t\right)\right]$$

where $g = 9.81\,\mathrm{m/s^2}$. For a parachutist with a drag coefficient $c = 15\,\mathrm{kg/s}$, compute the mass m so that the velocity is $v = 36\,\mathrm{m/s}$ at $t = 10\,\mathrm{s}$. Use the false-position method to determine m to a level of $\varepsilon_s = 0.1\%$.

Exercise 2 Use bisection to determine the drag coefficient needed so that an $82\,\mathrm{kg}$ parachutist has a velocity of $36\,\mathrm{m/s}$ after $4\,\mathrm{s}$ of free fall. Iterate until the approximate relative error falls below 0.1%. Also perform an error check by substituting your final answer into the original equation.

Exercise 3 Determine the highest real root of $f(x) = x^3 - 6x^2 + 11x - 6.1$
(a) Graphically.
(b) Using the Newton-Raphson method (iterate til $\varepsilon_s = 0.1\%$).

Exercise 4 Use the Newton-Raphson method to find the root of

$$f(x) = \exp(-0.5x)(4 - x) - 2$$

Employ initial guesses of (a) 2, (b) 6, and (c) 8. Explain your results.