Laboratory-2 | Part-B (Newton Raphson Method)

August 25, 2020

1. **Write a code** to find roots of an arbitrary function using Newton Raphson method.
   (a) Write Newton Raphson as a MATLAB function. Pass $f(x)$ as a function handle to this MATLAB function through its argument. Also pass the initial guess x_0 and the acceptable uncertainty in the root as arguments to this function.
   (b) Prinout out successive approximations to the root so that you can observe the convergence (or non-convergence) of successive iterations to the root. When it converges to the root you should observe how rapidly it does so - espcially check the increase in the number of accurate significant figures per iteration.
2. **Test your code** Use your code to find roots of (and compare against exact result).
   (a) $f(x) = x^2 - 4$
   (b) $f(x) = x^2 - 3x + 1$

   Comparison with exact results : compare results of your code with exact results.

   Convergence : Try out different initial guesses. Does the sequence x_n always converge to the root (atleast the one that you are looking for)?

   Rate of convergence:

   Observe the printed values of successive approximations. How rapidly is the accuracy increasing per iteration?

   How does number of steps N for desired accuracy change on changing acceptable uncertainty in root from 10^{-1} to 10^{-8} - a change of 7 orders of magnitude.

   How many steps of bisection method will take for the same 7 order magnitude of decrease in uncertainty ? *Hint: You can find this out by simple calculation by hand*
3. **Function with unknown roots** : Now **find the roots** of $x^6 - x - 1 = 0$. Try out different initial guesses for the root.