Aero 320: Numerical Methods

Lab Assignment 8

Fall 2013

Problem 1

Fixed point iteration method

Consider the equation

$$x^3 + 4x^2 - 10 = 0.$$

This equation can be expressed in the form $x = g(x)$ in the following ways.

(1) $x = g_1(x) = x - x^3 - 4x^2 + 10$,

(2) $x = g_2(x) = \sqrt{\dfrac{10 - 4x^2}{x}}$,

(3) $x = g_3(x) = 0.5\sqrt{10 - x^3}$,

(4) $x = g_4(x) = \sqrt{\dfrac{10}{x + 4}}$,

(5) $x = g_5(x) = x - \left(\dfrac{x^3 + 4x^2 - 10}{3x^2 + 8x}\right)$.

(a) With initial condition $x_0 = 1.5$ and a tolerance of 10^{-9}, obtain the root of the equation using the *fixedpoint iteration method*. How many iterations do you need in each case?

(b) Plot $g(x)$ for each case. Does it tell anything about convergence? What about $g'(x)$? For the method to converge, propose a good interval for x_0 in the case of the function $g_4(x)$.