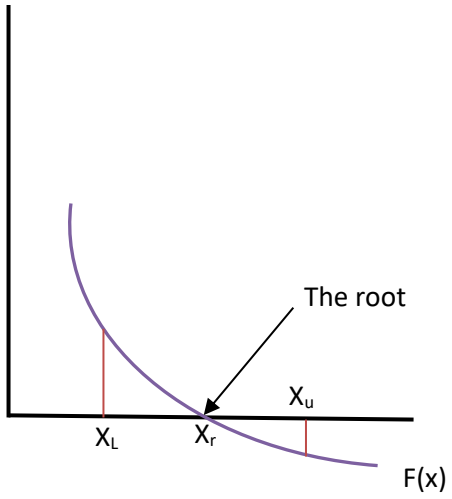
5.1 Introduction

The purpose of this chapter is to find numerically the roots of the given equation. Bracketing methods are used to find root that is trapped in a given interval. The beginning of the interval is called x-lower and the end is called x-upper. There are several methods can be used to find the roots.

5.2 Bisection method



The first assumption for x_r is

$$X_r = \frac{X_l + X_u}{2}$$

Substitute X_r in the equation. If the value of f(x) positive, eliminate the old X_l and put the new value as X_l. If the value of f(x) negative, eliminate the old X_u and put the new value as X_u. Repeat this process until reaching the optimum value of x (root of the equation).

Example (5.1): for the given equation f(x) = $-0.4x^2 + 2.2x + 4.7$ find the root of the equation by using Bisection Method. Using X_l=5, X_u=10, $\varepsilon = 5\%$.

Solution

X_l	$F(X_l)$	X_u	$F(X_u)$	X_r	$F(X_r)$	ε (%)
5	5.7	10	-13.3	7.5	-1.3	-----
5	5.7	7.5	-1.3	6.25	2.825	20
6.25	2.825	7.5	-1.3	6.875	0.91875	9.09
6.875	0.91875	7.5	-1.3	7.1875	-0.15156	4.34

$\therefore\ X_r = 7.1875$

H.W.: Use the graphical approach to determine the drag coefficient C needed for a parachutist of mass m = 68.1 kg to have a velocity of 40 m/s after free falling for time t = 10 s. *Note:* The acceleration due to gravity is 9.8 m/s^2

$f(c) = \frac{gm}{c}\left(1 - e^{-(c/m)t}\right) - v$. let C_L = 12, C_U = 16 , $\varepsilon = 5\%$