OMEGA ACADEMY, NUMERICAL METHODS COURSE.

Erika Jissel Gutiérrez Beltrán

Daniel Fernandez Delgado

Frank Edward Daza González

Johanna Arias

Freddy Sebastian Garcia

Teacher:

Walter German Magaña

Matter:

Numerical Methods

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UNIT FIVE

False position or False rule

This method allows the solution of linear equations and non-linear methods, combining bisection method and the secant method, obtaining iteratively result from two values based on any value (simple method).

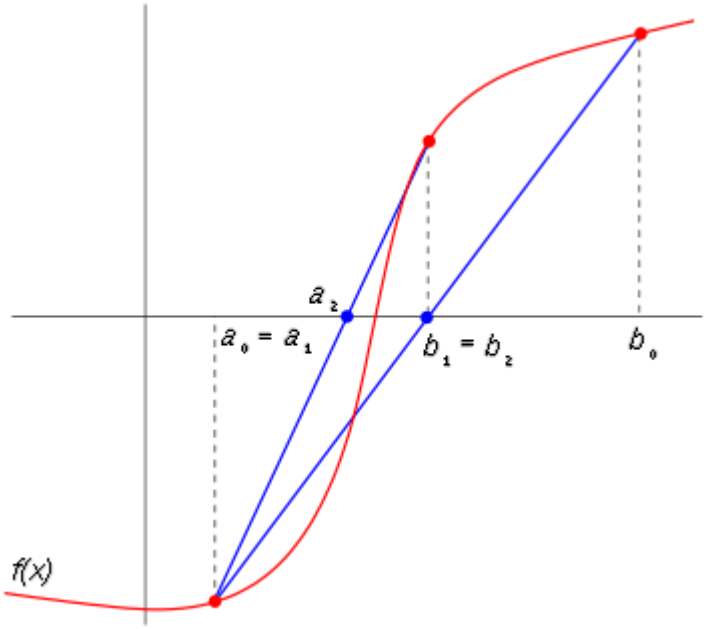

Image 1: graph of the false rule, taken from,
http://es.wikipedia.org/wiki/M%C3%A9todo_de_la_regla_falsa#med

To do so the following formulas are used.

- Formula of iterations.

$$x_1 = x_b \frac{f(x_b) * (x_a - x_b)}{f(x_a) - f(x_b)}$$

- Slope Formula

$$m = \frac{f(b) - f(a)}{b - a}$$

- Relative error

$$Er = \frac{|x_{new} - x_{old}|}{x_{new}}$$

- Selection of the new interval

$$f(x_a) - f(x_1)$$

Find the roots of the equation.

$F(x) = 2x^4 – 5x^2 + x$

First iteration:

$X_l = 1$ $f(x_l) = -2$

$X_u = 3.5$ $f(x_u) = 242.3$

$$Xr = 3.5 - \frac{242.3 - (1 - 3.5)}{(-2) - 242.3} = 4.502$$

$f(4.502) = 2(4.502)^2 – 5(4.502)^2 + 4.502 = 724.7$

Finding the new interval.

$f(x_l) * f(x_r) = -2 * 4.502 = -9.004$

Second iteration:

x_l =4.502 $f(x_l)$ = 724.7

x_u = 3.5 $f(x_r)$ = 242.3

$$Xr2 = 3.5 - \frac{242.3 - (4.502 - 3.5)}{724.7 \ - 242.3} = 2.9$$

$f(2.9) = 2(2.9)^4 – 5(2.9)^2 + (2.9) = 102.3$

Finding the new interval.

4.502 * 2.9 = 13.05

Third iteration:

x_l = 4.502 $f(x_l)$ = 724.7

x_u = 2.9 $f(x_u)$ = 102.3

$$Xr3 = 2.9 - \frac{102.3 - (4.502 - 2.9)}{724.7 \ - 102.3} = 2.7$$

$f(2.7) = 2(2.7)^4 – 5(2.7)^2 + (2.7) = 72.5$

Finding the new interval.

Fourth iteration:

$x_l = 4.502$ $f(x_l) = 724.7$

$x_u = 2.7$ $f(x_u) = 72.5$

$$Xr3 = 2.7 - \frac{72.5 - (4.502 - 2.7)}{724.7 \ - 72.5} = 2.6$$

$f(2.6) = 2(2.6)^4 – 5(2.6)^2 + (2.6) = 60.2$

Finding related error.

Relative error 1:

$$Er1 = \frac{|2.9 - 4.502|}{2.9} = -0.55$$

Relative error 2:

$$Er1 = \frac{|2.7 - 2.9|}{2.7} = -0.07$$

Relative error 3:

$$Er1 = \frac{|2.6 - 2.7|}{2.6} = -0.04$$

Table.

Far Left	Far Right	Midpoint	Value f(x)	Relative Error
1	3.5	4.502	724.7	
4.502	3.5	2.9	102.3	-0.33
4.502	2.9	2.7	72.5	0.2
4.502	2.7	2.6	60.2	-0.09