

# Bisection Method

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**Algorithm 1** Bisection

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1: procedure BISECTION
2:    $X_i$ 
3:    $X_s$ 
4:    $tol$ 
5:    $iter$ 
6:    $Y_i = f(X_i)$ 
7:    $Y_s = f(X_s)$ 
8:   if  $Y_i * Y_s \geq 0$  then
9:     "The roots are not equal"
10:  else if  $Y_i = 0$  then
11:    " $X_i$  is a root"
12:  else if  $Y_s = 0$  then
13:    " $X_s$  is a root"
14:  else
15:     $X_m = \frac{(X_i + X_s)}{2}$ 
16:     $Y_m = f(X_m)$ 
17:     $Error = tol * 2$ 
18:     $Cont = 1$  //Because an  $X_m$  was already compute
19:    while  $Y_m \neq 0$  &  $error > tol$  &  $cont \leq iter$  do
20:      if  $Y_m * Y_i < 0$  then
21:         $X_s = X_m$ 
22:         $Y_s = Y_m$ 
23:      else
24:         $X_i = X_m$ 
25:         $Y_i = Y_m$ 
26:      end if
27:       $Aux = X_m$ 
28:       $X_m = \frac{(X_i + X_s)}{2}$ 
29:       $err = \|X_m - Aux\|$ 
30:       $Cont = Cont + 1$ 
31:    end while
32:    if  $Y_m = 0$  then
33:      " $X_m$  is a root"
34:    else if  $error < tol$  then
35:       $X_m$  is a root with an error of error
36:    else if  $Cont > iter$  then
37:      "We have ran out of iterations"
38:    end if
39:  end if
40: end procedure
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