

Bisection

input : function f , bracket $[x_l, x_u]$ with $f(x_l) \cdot f(x_u) < 0$,
tolerance ε_s

output: estimate x_r of the root

$x_r \leftarrow x_l$

repeat

$x_{r,\text{old}} \leftarrow x_r$

$x_r \leftarrow (x_l + x_u) / 2$

 // keep the half that still brackets the root

if $f(x_l) \cdot f(x_r) < 0$ **then**

$x_u \leftarrow x_r$

else if $f(x_l) \cdot f(x_r) > 0$ **then**

$x_l \leftarrow x_r$

else

return x_r // exact root

end

$\varepsilon_a \leftarrow \left| \frac{x_r - x_{r,\text{old}}}{x_r} \right| \cdot 100\%$

until $\varepsilon_a < \varepsilon_s$

return x_r