Brent's Algorithm

Brent's Algorithm combines the best features of the Newton-Raphson and Bisection techniques. Similar to the Bisection technique, Brent's algorithm assumes the root can be bracketed in an interval $[a,b]$. Due to its rapid convergence rates, Brent's algorithm first attempts to find the root using the Newton-Raphson scheme. If the estimate of the root falls outside the interval $[a,b]$, then Bisection is used to narrow the interval and the process is repeated. Eventually, Bisection will narrow the interval sufficiently such that the Newton-Raphson scheme will converge.

Algorithm

Given a function F(x) for which the root is to be found:

a) Pick [a,b]

b) If $F(a)*F(b) > 0 \Rightarrow$ Stop, the function does not cross the axis within [a,b]

c) If $F(a)*F(b) < 0$ Then

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    xo = (a+b)/2

    δ = - F(xo)/F′(xo)

        while |δ/xo| > ε

        x = xo + δ

        if  x ∉ [a,b]   x = (a+b)/2

           if F(a)*F(x) > 0 then a = x

           if F(a)*F(x) < 0 then b=x

        xo = x

        δ = - F(xo)/F′(xo)

        continue
```