Secant Method- for Numerical Solutions

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Abstract- **In this we have studied the secant method which is used for numerical analysis. The secant method is a very effective numerical procedure used for solving nonlinear equations of the form f(x) = 0. It is derived via a linear interpolation we provide its error in closed form and analyze its order of convergence. We show that this order of convergence is greater than that of the secant method, and it increases as k increases.**

1. INTRODUCTION

The secant method is defined by recurrence Relation .in numerical analysis, the secant Method is root finding algorithm that uses a succession of roots of secant lines to better approximate root of function. This method was developed independently of Newton's method and predates it by over 3000 yrs. (2)

Method for secant method

As can be seen from recurrence relation, the secant method requires two intial values Xo and X1, which should ideally be chosen to lie close to the root.

2. SOME NUMERICAL BASED ON SECANT METHOD

(1) Find root of f(X) =(X)^3 – 5x- 7 =0 correct upto 3 decimal point .(1)

Ans: let's take intial approximations as Xo=1 and X1

1st iteration:

Xn+1 = Xn - (Xn – Xn – 1)// f(Xn)- f(Xn – 1) × f(Xn))Here will take n = 1. X2 = X1 - X1- X0 / f (X1)- f (X0). × f (X1)

= 2 - (2 – 1)/ – (-9-(-11) × (-9) 6.5.

2nd iteration: n= 2

X3 =X2 –(X2 - X1)/ f (X2) – f (X1) × f (X2)

= 6.5 – (6.5 – 2) / (235.125- (-9) × (235.125)

= 2.165899.

3rd iteration: n = 3.

X4= X3 - X3- X2 / f (X3) – f (X2) × f (X3)

2.165899 – (2.16589 – 6.5)/ (-7.699010) - (235.126) × (- 7 .6999010)

= 2.302798.

4th iteration: n= 4

X5 = X 4 – X 4 - X2 / f (x4) – f (X2). × f (X4)– (X 2) × f (X4)

2.302978 – 2.165899/ (-6.302537) –(7.669020) × (- 6 .302356)

= 2.944212.

5th iteration: n= 5

X6 = X5 - X5 - X4 / f (X3) – f (X4) × f (5)

=2.934212 – (2.941312 – 2.302798) / (3.591326) – (- 6.302356) × (0.732147)

= 2.743840.

6th iteration = n= 6

X7=X6 - X6 - X5 / f (X6) – (X5) × f (X6)

= 2.705018 – (2.70501- 2.934212)/ (- 0.792147) × (- 0.061944)

= 2.74980

7th iteration: n = 7

X8 = X7 - x7- x6 / f(X 7) – f (X6). × f (X 7)

2.743830 – (2.743830 –2.705018) /

(- 0.061944 – (- 0.732147). × (0.061944)

= 2.747417.

8th iteration: n = 8

X9 = X8 - X8 - X7 / f (X8) – f (X 7). × f(X8)

2.747417 – (2.747417 – 2.743830) /

(0.001247 – (- 0.061944) × (0.01247)

= 2.747346.

ITERATION No: 7:8th approximate to root X8 = 2.747417

ITERATION NO: 8:9thapproximate to root X9 = 2.747346.

(2)Alternate and shortcut method
If we select X0 and X1 such that root lies in interval X0 and X1 then we require less no. of iteration
Ans; f (1) ^3 – 5 (1) – 7 = - 11
F (2)3 – 5 (2) – 7 = - 9
Since both f (2.5) = (2.5) ^ 3 –5 (2.5) – 7 = - 3.875
F (3) = (3) ^ 3 -5 (3) -7 = 5
Root lies betn. 2.5 and 3 ,take X0 = 2.5 and X1 = 3 for secant method .

Iteration no: 1
X2 = X1 - X1 - X0 / f (X1) – f (X0) × f (X1)
= 3 – (3 –2.5) / (5) – (-3.875) × 5
=2.718310.

Iteration no: 2 n= 2
X3 = X2 - (X2 - X1)/ fX2 – f (X1) × f (X2)
2.718310–(2.718310–3)/ (-0.5053919) - (5). * (-0.505391)
= 2.744169.

Iteration no: 3
2.744169 – (2.744169-2.718310)/ (-0.055984) – (-0.50391)
= 2.747390.

Iteration no: 4
2.747390 – (2.757390 –2.744169) / (0.000769- (-0.05984)
= 2.747346.

We have obtained in two last successive iterations
Iteration no 3 and 4 approximate to root x4 = 2.747390
Iteration no 4 and 5 approximate to root X5 = 2.747346

3. ADVANTAGE FOR SECANT METHOD

1. Does not require evaluation of derivative.
2. Easier to implement than Newton's method.
3. May be used to find complex roots.

4. CONCLUSION

In this paper we have understood the secant method we have conclude that the secant method is most effective method this is equal to fact it has a converging rate close to Newton Raphson method but requires only a single evolution per iteration. But we also conclude the convergence of bisection because the rate is to slow and quit difficult to extend use of system equation. (3)

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