

PERTEMUAN 5 : PRAKTIKUM METODE NUMERIK

Persamaan Non Linier (PART 2)

Metode Newton Raphson dan Metode Secant

PRETEST

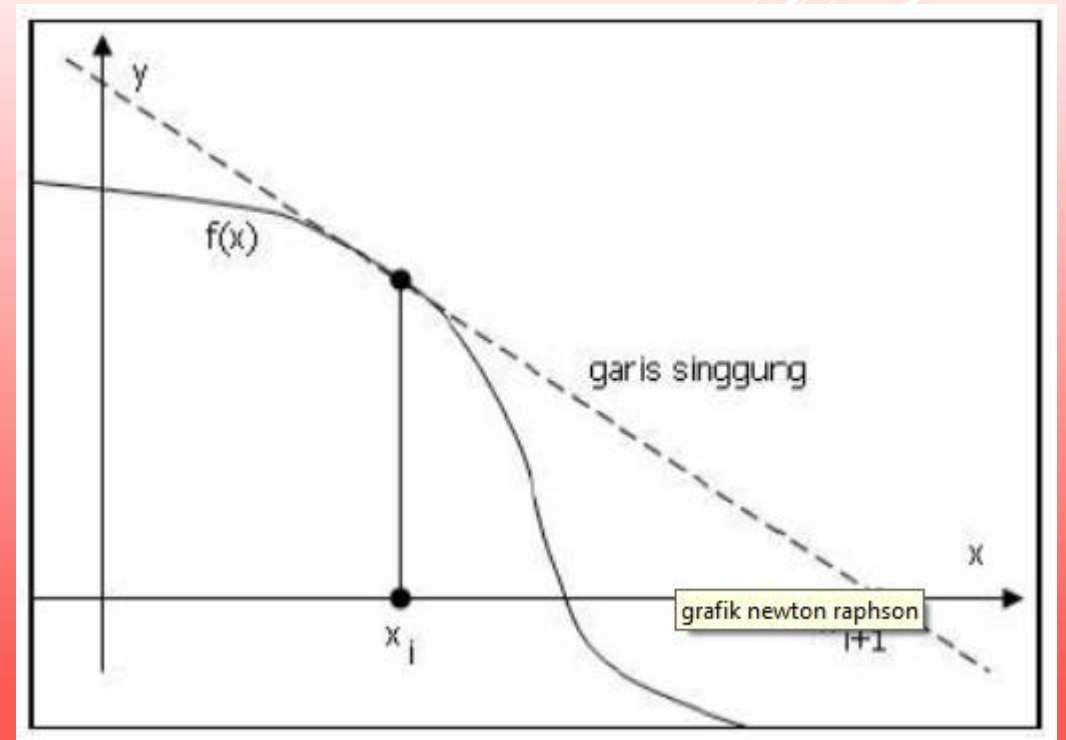
1. **Apa yang anda ketahui tentang metode Newton Raphson ?**
2. **Apa yang anda ketahui tentang metode Secant ?**
3. **Apa kelemahan metode Newton Raphson dalam penyelesaian persamaan non linier ?**
4. **Apa perbedaan antara metode Secant dengan metode Regula Falsi ?**

METODE NEWTON RAPHSON

Metode Newton Raphson merupakan metode yang didasarkan pada deret Taylor yang diekspansi pada suatu titik awal x_0 .

Penentuan nilai x selanjutnya dapat dirumuskan :

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$



METODE NEWTON RAPHSON

Metode ini akan selalu konvergen **jika** aproksimasi awal dekat dengan akar sesungguhnya. Hal ini menjadi kelemahan **utama** penggunaan metode ini. Selain itu, kelemahan metode ini adalah khususnya pada saat penentuan fungsi

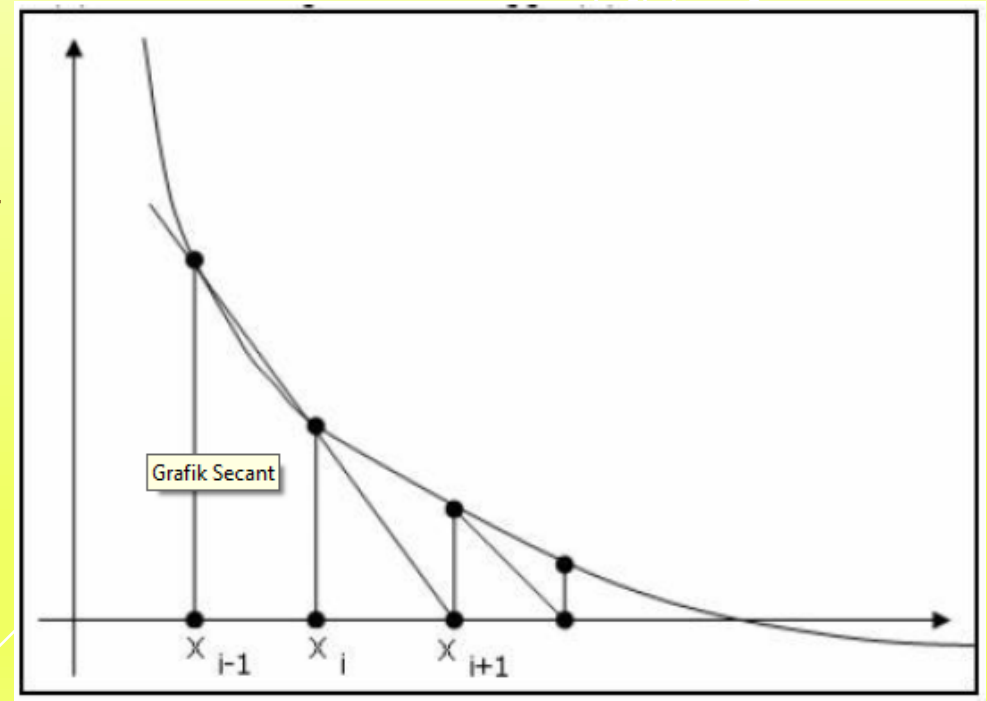
turunan. Misalkan $y = \frac{e^{\sin(2x^2)}}{x^3 - \tan(x)}$ akan diperoleh $y = \frac{e^{\sin(2x^2)} \cdot (\tan^2 x - 2x + 1)}{(\tan x - x^2)^2 - \left(\frac{4xe^{\sin(2x^2)} \cos(2x^2)}{\tan x - x^2} \right)}$

METODE SECANT

Metode ini hampir sama dengan metode Regula Falsi. Bedanya adalah metode ini tidak mensyaratkan agar akar penyelesaian $f(x)$ berada di tengah interval x_0 dan x_1 .

Untuk menentukan nilai x_n selanjutnya dapat

$$\text{Dirumuskan : } x_{n+1} = x_n - \frac{f(x_n)(x_n - x_{n-1})}{f(x_n) - f(x_{n-1})}$$



LET'S GO TO CODING MATLAB 😊



METODE NEWTON RAPHSON

```
function y = Metode_Newton_Raphson (f, x0, n, tol)
    f_asli = sym(f)
    f_turunan = diff(f_asli,'x')
    y = double(x0);
    i = 0;
    fa = subs (f_asli,y);
    fprintf('Iter      fa      fb      y\n');
    while (abs(fa) > tol)
        fa = subs (f_asli,y);
        fb = subs (f_turunan,y);
        if fa == 0 || i == n
            break
        end
        y = double (y - fa./fb);
        nilai_y = double(y);
        nilai_fa = double(fa);
        nilai_fb = double(fb);
        fprintf('%3.0f      %5.4f      %5.4f      %5.4f\n',i,nilai_fa,nilai_fb,nilai_y);
        %disp ([i nilai_y nilai_fa])
        i = i + 1;
    end
```

METODE SECANT

```
function x = Metode_Secant (f, x0, n, tol)
    fa = f(x0);
    x1 = x0-1;
    fb = f(x1);
    i = 0;
    fprintf('Iter    x0        x1        x        abs(x0-x1)        fa\n');
    while (abs (x0 - x1) > tol)
        fa = f(x0);
        fb = f(x1);
        if (fa == 0 || i == n)
            return
        end
        x = x1 - fb.*(x1-x0)./(fb-fa);
        %disp([i x fa])
        x0=x1;
        x1=x;
        fprintf('%3.0f    %4.2f    %4.2f    %4.2f    %5.4f    %5.4f\n',i,x0,x1,abs(x0-x1),x,fa);
        i=i+1;
    end
```


TRY THIS

1. $y = x^3 - 2x^2 + 3$ dengan $x_0 = 3$,

2. $y = e^x - \sin x$ dengan $x_0 = 1$

($n = 20$, $\varepsilon = 0,0001$)

What do you get??

NO : 1 NEWTON RAPHSON'S METHOD

```
>> y =  
Metode_Newton_Raphson(f,3,20,0.00001  
)  
f_asli =  
x^3 - 2*x^2 + 3  
f_turunan =  
3*x^2 - 4*x
```

| Iter | fa | fb | y |
|------|---------|---------|---------|
| 0 | 12.0000 | 15.0000 | 2.2000 |
| 1 | 3.9680 | 5.7200 | 1.5063 |
| 2 | 1.8798 | 0.7816 | -0.8988 |
| 3 | 0.6580 | 6.0191 | -1.0082 |
| 4 | -0.0574 | 7.0818 | -1.0000 |
| 5 | -0.0003 | 7.0005 | -1.0000 |
| 6 | -0.0000 | 7.0000 | -1.0000 |

```
y =  
-1
```

NO : 1 SECANT'S METHOD

```
>> y = Metode_Secant(f,3,20,0.0001)
```

| Iter | x0 | x1 | x | fa |
|------|--------|--------|----------|--------------|
| 0 | 3.00 | 2.00 | 1.6667 | 12.0000 |
| 1 | 2.00 | 1.67 | 0.9200 | 3.0000 |
| 2 | 1.67 | 0.92 | 132.7528 | 2.0741 |
| 3 | 0.92 | 132.75 | 0.9199 | 2.0859 |
| 4 | 132.75 | 0.92 | 0.9198 | 2304300.0632 |
| 5 | 0.92 | 0.92 | 2.7480 | 2.0860 |
| 6 | 0.92 | 2.75 | 0.3386 | 2.0862 |

| | | | | |
|----|-------|-------|---------|---------|
| 7 | 2.75 | 0.34 | -0.8208 | 8.6486 |
| 8 | 0.34 | -0.82 | -1.5665 | 2.8095 |
| 9 | -0.82 | -1.57 | -0.9405 | 1.0998 |
| 10 | -1.57 | -0.94 | -0.9811 | -5.7521 |
| 11 | -0.94 | -0.98 | -1.0008 | 0.3993 |
| 12 | -0.98 | -1.00 | -1.0000 | 0.1306 |
| 13 | -1.00 | -1.00 | -1.0000 | -0.0059 |

y =
-1.0000

NO : 2 NEWTON RAPHSON'S METHOD

```
>> y = Metode_Newton_Raphson(f,1,20,0.00001)
```

```
f_asli =
```

```
exp(x) - sin(x)
```

```
f_turunan =
```

```
exp(x) - cos(x)
```

```
Iter   fa      fb      y
```

```
0   1.8768   2.1780   0.1383
```

```
1   1.0105   0.1578  -6.2635
```

```
2  -0.0178  -0.9979  -6.2813
```

```
3   0.0000  -0.9981  -6.2813
```

```
y =
```

```
-6.2813
```

NO : 2 SECANT'S METHOD

```
>> y = Metode_Secant(f,1,20,0.0001)
```

| Iter | x0 | x1 | x | x0-x1 | fa |
|------|-------|-------|-------|---------|------------------|
| 0 | 0.00 | -1.14 | 1.14 | -1.1405 | 1.8768 |
| 1 | -1.14 | 4.99 | 6.13 | 4.9912 | 1.0000 |
| 2 | 4.99 | -1.19 | 6.18 | -1.1918 | 1.2285 |
| 3 | -1.19 | -1.24 | 0.05 | -1.2437 | 148.0759 |
| 4 | -1.24 | 23.56 | 24.81 | 23.5648 | 1.2327 |
| 5 | 23.56 | -1.24 | 24.81 | -1.2437 | 1.2353 |
| 6 | -1.24 | -1.24 | 0.00 | -1.2437 | 17142435237.4305 |

```
y =  
-1.2437
```

PRAKTIKUM PERTEMUAN 4 SUDAH SELESAI

Sekarang bersiaplah PostTest

Several thin, parallel white lines are drawn diagonally across the bottom right corner of the slide, extending from the right edge towards the bottom left.

SEMANGATT!!!!

Finish
Any Question ?