

PRAKTIKUM METODE NUMERIK

PERTEMUAN 9 :
INTEGRASI NUMERIK

Definisi Integrasi Numerik

Perhitungan integral adalah perhitungan dasar yang digunakan dalam kalkulus, dalam banyak keperluan.

digunakan untuk menghitung luas daerah yang dibatasi oleh fungsi $y = f(x)$ dan sumbu x .

Penerapan integral : menghitung luas dan volume benda putar

Macam – Macam Metode Integrasi

-Metode Newton-Cotes

- Metode Reimann
- Metode Trapezoida
- Metode Simpson $\frac{1}{3}$
- Metode Simpson $\frac{3}{8}$

- Metode Ekstrapolasi Richardson (Romberg, dll)

- Metode Integrasi Gauss (Metode Gauss Legendre - 3 titik, Metode Gauss Kuadratur - 2 titik)

Dasar Formula Newton-Cotes

Berdasarkan pada

$$I = \int_a^b f(x)dx \cong \int_a^b f_n(x)dx$$

Dimana nilai hampiran $f(x)$ dengan polinomial

$$f_n(x) = a_0 + a_1x + \cdots + a_{n-1}x^{n-1} + a_nx^n$$

Let's go to coding MATLAB



Metode Trapezoida

```
function F = trapezoidal(f,a,b,n)
    h = (b-a)/n;
    S = feval(f,a);
    for i = 1:n-1
        x(i) = a + h*i;
        S = S + 2*feval(f,x(i));
    end
    S = S + feval(f,b);
    F = (h/2)*S;
end
```

Metode Simpson $\frac{1}{3}$

```
function F = simpson1per3(f,a,b,n)
    h = (b-a)/n;
    S = feval(f,a);
    for i = 1:2:n-1
        x(i) = a + h*i;
        S = S + 4*feval(f,x(i));
    end
    for i = 2:2:n-1
        x(i) = a + h*i;
        S = S + 2*feval(f,x(i));
    end
    S = S + feval(f,b);
    F = (h/3)*S;
end
```

Metode Simpson $\frac{3}{8}$

```
function F = simpson3per8(f,a,b,n)
    h = (b-a)/n;
    S = feval(f,a);

    for i = 1:2:n-1
        x(i) = a + h*i;
        S = S + 3*feval(f,x(i));
    end

    for i = 2:2:n-1
        x(i) = a + h*i;
        S = S + 3*feval(f,x(i));
    end

    S = S + feval(f,b);
    F = (3*h/8)*S;
end
```


Hasil Eksak

```
>> eksak = quad(f,-2,2)
```

Octave Ver.

```
>> eksak = integral(f,-2,2)
```

Matlab Ver.

Try This

Sekarang cobalah tentukan Luas jika diketahui $a = 0$, $b = 1$,
 $n = 10$, $f(x) = x^2$

Trapezoida

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
f(x)	0	0.01	0.04	0.09	0.16	0.25	0.36	0.49	0.64	0.81	1

$$L = h \cdot \sum_{i=0}^{10} f(x_i)$$

$$= \frac{0.1}{2} \left(0 + 2 * 0.01 + 2 * 0.04 + 2 * 0.09 + 2 * 0.16 + 2 * 0.25 + \right. \\ \left. 2 * 0.36 + 2 * 0.49 + 2 * 0.64 + 2 * 0.81 + 1.00 \right)$$

$$= \frac{0.1}{2} \left(0 + 0.02 + 0.08 + 0.18 + 0.32 + 0.5 + \right. \\ \left. 0.72 + 0.98 + 1.28 + 1.62 + 1.00 \right)$$

$$= \left(\frac{0.1}{2} \right) (6.7) = 0.335$$

$$L = \int_0^1 x^2 dx = \frac{1}{3} x^3 \Big|_0^1 = 0.3333.....$$

Simpson $\frac{1}{3}$

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
f(x)	0	0.01	0.04	0.09	0.16	0.25	0.36	0.49	0.64	0.81	1

$$L = h \cdot \sum_{i=0}^{10} f(x_i)$$

$$= \frac{0.1}{3} \left(0 + 4 * 0.01 + 2 * 0.04 + 4 * 0.09 + 2 * 0.16 + 4 * 0.25 + \right. \\ \left. 2 * 0.36 + 4 * 0.49 + 2 * 0.64 + 4 * 0.81 + 1.00 \right)$$

$$= \frac{0.1}{3} \left(0 + 0.04 + 0.08 + 0.36 + 0.32 + 1 + \right. \\ \left. 0.72 + 1.96 + 1.28 + 3.24 + 1.00 \right)$$

$$= \left(\frac{0.1}{3} \right) (10) = 0,333$$

$$L = \int_0^1 x^2 dx = \frac{1}{3} x^3 \Big|_0^1 = 0,3333.....$$

Simpson $\frac{3}{8}$

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
f(x)	0	0.01	0.04	0.09	0.16	0.25	0.36	0.49	0.64	0.81	1

$$L = h \cdot \sum_{i=0}^{10} f(x_i)$$

$$= \frac{0.1 * 3}{8} \left(0 + 3 * 0.01 + 3 * 0.04 + 3 * 0.09 + 3 * 0.16 + 3 * 0.25 + \right. \\ \left. 3 * 0.36 + 3 * 0.49 + 3 * 0.64 + 3 * 0.81 + 1.00 \right)$$

$$= \frac{0.3}{8} \left(0 + 0.03 + 0.12 + 0.27 + 0.48 + 0,75 + \right. \\ \left. 1.08 + 1.47 + 1.32 + 2.43 + 1.00 \right)$$

$$= \left(\frac{0.3}{8} \right) (8,95) = 0,336$$

$$L = \int_0^1 x^2 dx = \frac{1}{3} x^3 \Big|_0^1 = 0,3333.....$$

Praktikum Pertemuan 9 Sudah Selesai

Sekarang bersiaplah untuk
Posttest

Posttest

Tentukan Nilai eksak dan Nilai Integral Trapezoidal, Simpson $\frac{1}{3}$ dan Simpson $\frac{3}{8}$. menggunakan $h=1$, $h=0.5$ dan $h=0,1$ dari fungsi dibawah ini :

a.

$$f(x) = \int_{-2}^2 x e^{2x} dx$$

b.

$$f(x) = \int_0^{10} x^2 + \sin(2x) dx$$