

Yıldız Teknik Üniversitesi
Elektrik-Elektronik Fakültesi
Bilgisayar Mühendisliği Bölümü

BLM2642

Bilgisayar Mühendisliği İçin Diferansiyel
Denklemler

Gr:2

Ödev 2

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KONU: 1. mertebeden sabit katsayılı n terimli doğrusal adi diferansiyel denkleminin Runge Kutta-4 yöntemiyle sayısal çözümünü C dilinde kodlayınız.

Denklemleri saklamak için her terimin katsayısı ve üssünü tutan bir struct yapısı oluşturdum. Bu structtan oluşan array ile denklemleri tuttum. Runge Kutta 4'ün formülünü koda döktüm ve aşağıdaki örnekler ile test ettim. İlk 3 örneği bilindik olması için atozmath.com'dan aldım. 4. Örneği ise kendim verdim. Gerçek değerleri wolframalpha ile buldum.

Örnek 1:

Find $y(0.2)$ for $y'=(x-y)/2$, $x_0=0, y_0=1$, with step length 0.1

$$2y'+y=x, y(0)=1, x = 0.2$$



NATURAL LANGUAGE



MATH INPUT

Differential equation solution at particular point

$$y(0.2) = 0.914512$$

```
C:\ce\2x1\diff\odev2\odev233 x + v
Ay' + By = f(t)
A degerini giriniz: 2
B degerini giriniz: 1
Kac terim olacagini(n) giriniz:1
1.terimin katsayisini giriniz: 1
1.terimin derecesini giriniz: 1
Baslangic t degeri: 0
Baslangic y degeri: 1
Hedeflenen deger: 0.2
Adim buyuklugu: 0.1
y(0.100000):0.953688 k1:-0.050000 k2:-0.046250 k3:-0.046344 k4:-0.042683
y(0.200000):0.914512 k1:-0.042684 k2:-0.039117 k3:-0.039206 k4:-0.035724
-----
Process exited after 106.7 seconds with return value 0
Press any key to continue . . . |
```

Mutlak Hata:0

Örnek 2

Find $y(0.5)$ for $y'=-2x-y$, $x_0=0, y_0=-1$, with step length 0.1

$$y'=-2x-y, y(0)=-1, x = 0.5$$



NATURAL LANGUAGE



MATH INPUT

Differential equation solution at particular point

$$y(0.5) = -0.819592$$

```
Ay' + By = f(t)
A degerini giriniz: 1
B degerini giriniz: 1
Kac terim olacagini(n) giriniz:1
1.terimin katsayisini giriniz: -2
1.terimin derecesini giriniz: 1
Baslangic t degeri: 0
Baslangic y degeri: -1
Hedeflenen deger: 0.5
Adim buyuklugu: 0.1
y(0.100000):-0.914513 k1:0.100000 k2:0.085000 k3:0.085750 k4:0.071425
y(0.200000):-0.856193 k1:0.071451 k2:0.057879 k3:0.058557 k4:0.045596
y(0.300000):-0.822455 k1:0.045619 k2:0.033338 k3:0.033952 k4:0.022224
y(0.400000):-0.810961 k1:0.022246 k2:0.011133 k3:0.011689 k4:0.001077
y(0.500000):-0.819593 k1:0.001096 k2:-0.008959 k3:-0.008456 k4:-0.018058
```

Mutlak Hata:0.000001

Örnek 3

Find $y(0.2)$ for $y'=-y$, $x_0=0, y_0=1$, with step length 0.1

$y'=-y, y(0)=1, x = 0.2$

NATURAL LANGUAGE

MATH INPUT

EXTENDED KEYBOARD

EXAMPLES

UPLOAD

compute input

Input

$\{y'(x) = -y(x), y(0) = 1, x = 0.2\}$

Separable equation

$$-\frac{y'(x)}{y(x)} = 1$$

ODE classification

first-order linear ordinary differential equation

Alternate form

$\{y'(x) + y(x) = 0, y(0) = 1, x = 0.2\}$

Differential equation solution

Approximate form

☒ Step-by-step solution

$y(x) = e^{-x}$

Differential equation solution at particular point

$y(0.2) = 0.818731$



```
Ay' + By = f(t)
A degerini giriniz: 1
B degerini giriniz: 1
Kac terim olacagini(n) giriniz:0
Baslangic t degeri: 0
Baslangic y degeri: 1
Hedeflenen deger: 0.2
Adim buyuklugu: 0.1
y(0.100000):0.904837 k1:-0.100000 k2:-0.095000 k3:-0.095250 k4:-0.090475
y(0.200000):0.818731 k1:-0.090484 k2:-0.085960 k3:-0.086186 k4:-0.081865
```





Mutlak Hata: 0

Örnek 4

Given $y' = -10x^2 - 3y$, $y(0) = -1$, $h = 0.1$, $y(0.2) = ?$

$y' = -10x^2 - 3y$, $y(0) = -1$, $x = 0.2$

 NATURAL LANGUAGE  MATH INPUT

 EXTENDED KEYBOARD  EXAMPLES  UPLOAD  compute input

Input

$\{y'(x) = -10x^2 - 3y(x), y(0) = -1, x = 0.2\}$

ODE classification

first-order linear ordinary differential equation

Alternate form

$\{10x^2 + y'(x) + 3y(x) = 0, y(0) = -1, x = 0.2\}$

Differential equation solution

Approximate form ☒ Step-by-step solution

$$y(x) = \frac{1}{27}(-90x^2 + 60x - 7e^{-3x} - 20)$$

Differential equation solution at particular point

$y(0.2) = -0.571914$

```
Ay' + By = f(t)
A degerini giriniz: 1
B degerini giriniz: 3
Kac terim olacagini(n) giriniz:1
1.terimin katsayisini giriniz: -10
1.terimin derecesini giriniz: 2
Baslangic t degeri: 0
Baslangic y degeri: -1
Hedeflenen deger: 0.2
Adim buyuklugu: 0.1
y(0.100000):-0.743940 k1:0.300000 k2:0.252500 k3:0.259625 k4:0.212112
y(0.200000):-0.571954 k1:0.213182 k2:0.168705 k3:0.175376 k4:0.130569

-----
Process exited after 47.55 seconds with return value 0
Press any key to continue . . . |
```

Mutlak Hata:0