MATLAB

Row vector , []

Column vector ; [] row vector + column vector do gives value, don’t report errors

Dot product

Dot division

Transpose a=[2,3,4] b=a’

Matrix c=[1,2,3;4,5,6] d=c’

Describe x in a range with equally spaced x1=[0:0.01:1]

Y1=sin(2\*pi\*x1)

Plot(x1,y1)

Q1. x from 0 to 5 with space 0.01, plot y =cos(x/2)

x=0:0.01:5

Y=cos(1/2\*x)

Plot(x,y)

Plot 2 figure in same picture. plot(x4,y4,'k-',x5,y5,'g--')

Q2.source 1001 x values between 0 and 1. I)exp[-x] ii)exp[-2x] iii)log[x+1]

x=0:0.001:1;

y1=exp(-x);

y2=exp(-2\*x);

y3=log(x+1);

plot(x,y1,'k-',x,y2,'g--',x,y3,'r\*')

multiple calculation at a same time

>>mat\_1 = [1,0;0,1] press enter + shift

mat\_2=[2,3;4,5] press enter

gives the 2 matrixes

Q3) show graphically that e~ (1+1/n)^(n) as n gets larger

Q4) Show graphically that sin(3 pi x)/x tends to 3\*pi as x tends to 0

Q5) plot cos(2\*x),cos(x^3) and x\*cos(2x)-cos(x^3) between 0 and 1

Q3)

X7=[0:0.01:1]

Y7=(1+1./x7).^(x7)

X8=[15,100]

Y8=[exp(1),exp(1)];

Plot(x7,y7,’k-’,x8,y8,’b-’)

Q4)

X9=0.01:0.01:0.5

Y9=sin(3\*pi\*x9)./x9

X10=[0.01,0.5];

Y10=[3\*pi,3\*pi];

Plot(x9,y9,’k-’,x10,y10,’b-’)

Q5)

>>x= linspace(0,1,100);

>> y\_1=cos(2\*x);

>> y\_2=cos(x.^3);

>> y\_3= x.\*y\_1-y\_2;

>> plot(x,y\_1,'k-',x,y\_2,'g-',x,y\_3,'r--')

CLASS 2

Open filename.md

In-build function : Zeros (row number, column number), mostly used in this field

Matlab starts 1

For loop, dummy variable I starts from initial value 0. Execute the code between for and end.

For I = 1:3

Forward Euler Method : initial value problem

Hold on / hold off : 多图共存。 Plot（x1,y1）; plot(x2,y2) 只会输出(x2,y2)的图像

Plot(x1,y1); Hold on; plot(x2,y2); hold off 两张图像并存

Q1.

Text

Description automatically generated

Q3

Graphical user interface, text, application

Description automatically generated

Text

Description automatically generated

Text

Description automatically generated

Q5.Graphical user interface, text, application

Description automatically generated

WEEK3 BACKWORD EULAR

* initialize every thing

Q1 Using the backward Euler method, solve dy/dt=y^2 for t between 0 and 1 with a variety of choices of timestep. Y(0)=1, plot these on the same graph.

T\_vals exact solution , make comparison nicely diverge close to 1

LEAP FROG METHOD

* Q2 same equation as q1, with t between 0 and 0.95, y(0)=1

Forward eular to calculate Second value of y. then use the leap frog method to calculate the rest of y values.

Cover forward eular

Q3 d^(2)y/dt^(2) + 6 dy/dt +t cosh(y^2) = 0, y(0)=1, dy/dt(0)=-1. solve this equation using the forward Euler method for t between 0 and 2. Plot two separate figures for y against t and the phase plane.

Second order ODE

D^(2)y/dt^(2)+3 dy/dt-cos(y)=0,y(0)=0,dy/dt(0)=1

V(t)= dy/dt

Dv/dt=d/dt (dy/dt) = cos(y)-3 dy/dt

Dy/dt=v,dv/dt=cos(y)-3v

Q4 invesitigate, in your own way, the order of error for both methods used in q1 and q2. Use a variety of choices for timestep.

Code shown on class plot error

WEEK 4

Q1 order of accuracy

using any method you choose, show that the leap frog method is not O(h^3) accurate for the simple harmonic oscillator d^(2)y/dt^(2)+(pi^2)\*y=0,for t between 0 and 1,y(0)=0,dy/dt(0)=3\*pi

Exact solution: y(t)=3 sin(pi t)

Q2

Using an RK2 scheme, solve dx/dt=x^2+y\*t^2,dy/dt=z\*t,dz/dt=t\*sin(t) for t between 0 and 1, x(0)=0,y(0)=0,z(0)=1. Plot two figures, the first showing x,y and z against t and the second showing the distance of the co-ordinate (x,y,z) from the origin at all times.

Dz/dt = t sin(t) 🡺z(t)=1+sin(t) – t cos(t) using z(0)=1

Y(t)+c = int(t+t sin(t)-t^2 cos(t)) dt = (1/2)t^2 +sin(t)- t cos(t) – t^2 sin(t) +2 int t sin(t) dt

= (1/2)t^2 +sin(t) – t cos(t) – t^2 sin(t)+ 2 sin(t)-2t cos(t)

= (1/2)t^2+3 sin(t)-3t cos(t) – t^2 sin(t)

Y(0)=0 🡺 c=0

🡺y(t)= (1/2)t^2+3 sin(t)-3t cos(t) – t^2 sin(t)

Q3 Evaluate the 1D wave equation du/dt=du/dx using the forward eular method for t between 0 and 2, x between -3 and 3 given u(x,0)=exp(-30\*x^3).

Q4 slove eg2, this time using the Lax-Friedrichs method as opposed to the forward Eular scheme.

Eg1. Dy/dt = y\*sin(t)^2, y(0)=1 RK2 scheme t between o and 1

Eg2. Du/dt=du/dx t between 0 and 3 u(x,0)=sin(-3x^2) forward eular