Matlab M file for various ODE algorithms

1 Advanced Engineering Mathematics

1. MATLAB Application (Euler & Runge-Kutta & Exact Solution 비교)

```
clear all                       %모든변수 제거
a=0;b=1;n=10;                   %구간(0,1)
x=0;y=1;                        %초기점0에서 초기값1
h=(b-a)/n;                      %간격
%euler법
for i=0:10                      %간격당 값을 저장할 공간을 만들기위해
    y1(i+1)=y;
    x=i*h;
    f=x*y;                      %기울기 y'=xy
    y=y+h*f;                    %euler법 기울기 1개로 푼다
    x0(i+1)=x;
end
%R-K법
yy=y1(1);                       %초기값
for i=0:10;
    y3(i+1)=yy;
    k1=h*(yy*x0(i+1));          %기울기 2개평균이용
    k2=h*(yy*(x0(i+1)+h));      %Runge-kutta법
    yy=yy+(k1+k2)/2;
end
```

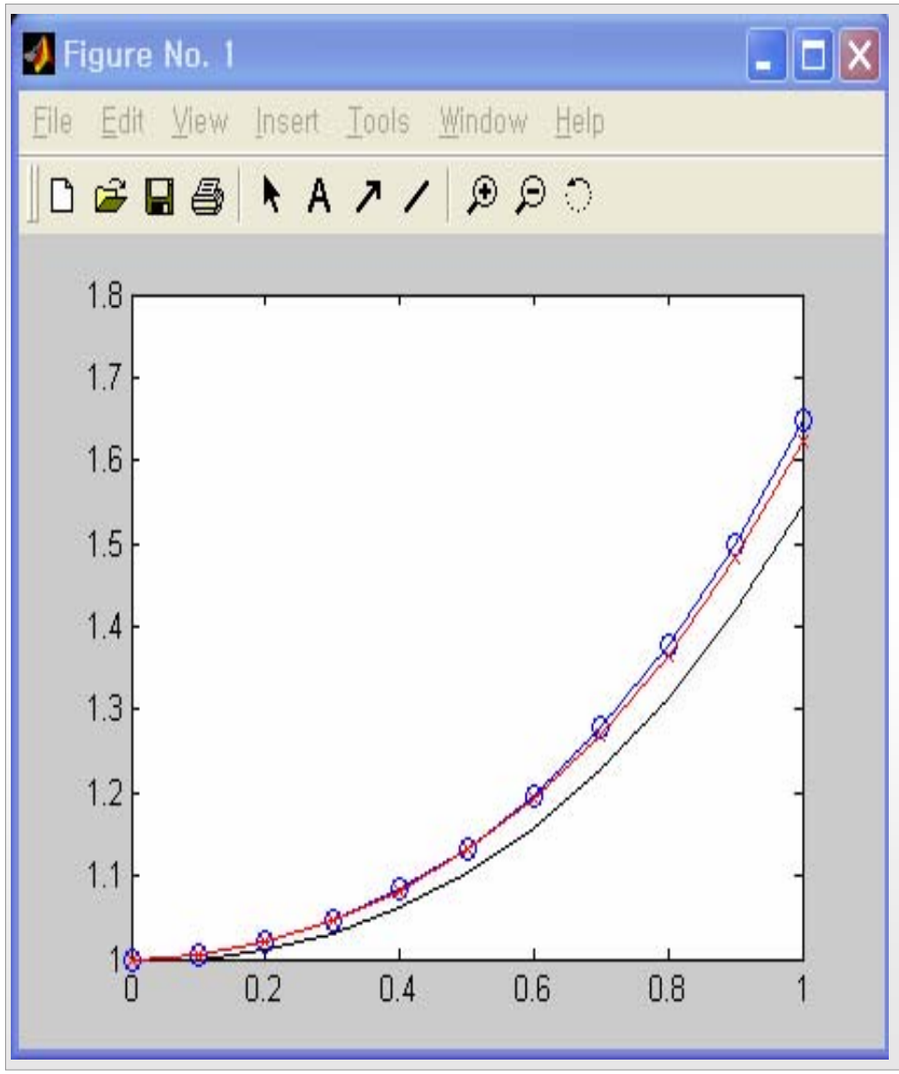
1 Advanced Engineering Mathematics

1. MATLAB M file (Euler & Runge-Kutta & Exact Method 비교)

```
%Exact
y=dsolve('Dy=x+y','y(0)=1','x');   %Symbolic solution of ODE (eqn,초기조건,치환)
y2=subs(y,x0,'x');                 %기호변수의 치환(수식, 현재기호변수,새로운기호변수)
%Result
disp(' ')
t='------------------------------------ ';
disp(t)
disp('  h       exact       euler       R-K  ')
disp(t)
h=(0:0.1:1);
for i=1:11
    fprintf(' %3.1f     %8.5f     %8.5f     %8.5f \n',h(i),y2(i),y1(i),y3(i));
end
    disp(t)
    disp(' ')
plot(h,y1,'k-',h,y2,'b-o',h,y3,'r-x')
```

1 Advanced Engineering Mathematics

1. Plot (Euler & Runge-Kutta & Exact Method 비교)



비교

Black Euler

Red R-K

Blue Exact

```
>>
-----------------------------------
 h       exact       euler       R-K
-----------------------------------
 0.0     1.00000     1.00000     1.00000
 0.1     1.00501     1.00000     1.00500
 0.2     1.02020     1.01000     1.02007
 0.3     1.04603     1.03020     1.04558
 0.4     1.08329     1.06111     1.08217
 0.5     1.13315     1.10355     1.13087
 0.6     1.19722     1.15873     1.19307
 0.7     1.27762     1.22825     1.27062
 0.8     1.37713     1.31423     1.36591
 0.9     1.49930     1.41937     1.48202
 1.0     1.64872     1.54711     1.62281
-----------------------------------
```