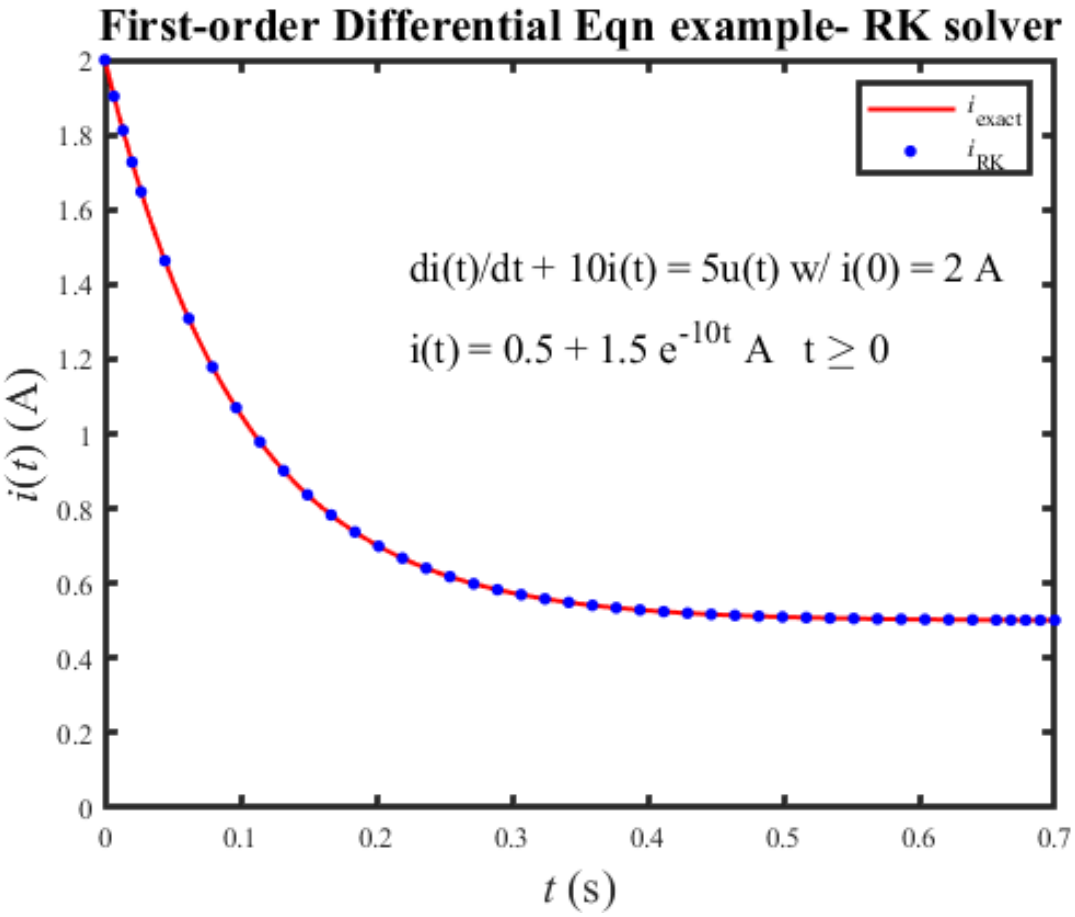
```
% Numerical ODE Solution Example (chap2_1ODE_RK_soln.m)
%
% Find approximate numerical solution to the first-order
% ordinary differential equation (ODE)
%               di/dt + 10i = 5u(t) w/ i(0) = 2A
% using an explicit Runge-Kutta (4,5) formulation (ode45 MATLAB
command).
% Compare numerical results with exact solution.
clear;clc;close all;
% Runge-Kutta solution
tspan = [0 0.7];      % vector w/ initial and final times
i0 = [2];             % initial condition, i.e., i(t=0) = 2 A
[trk,irk] = ode45(@ODE_RK_example1,tspan,i0); % call a MATLAB ODE
solver
% Analytic solution for comparison
texact=0:0.005:0.7;             % Define time steps for analytic sol'n
iexact=0.5+1.5*exp(-10*texact); % Analytic solution to i(t) for ODE
%
plot(texact,iexact,'r',trk,irk,'b.')
legend(' {\iti}_{exact}',' {\iti}_{RK}'), axis([0 0.7 0 2])
ylabel('{\iti}({\itt}) (A)','fontsize',16,'fontname','times')
xlabel('{\itt} (s)','fontsize',16,'fontname','times')
title('First-order Differential Eqn example- RK solver','fontsize',...
    16,'fontname','times')
text(0.225,1.45,'di(t)/dt + 10i(t) = 5u(t) w/ i(0) = 2
A','fontsize',...
    14,'fontname','times')
text(0.225,1.25,'i(t) = 0.5 + 1.5 e^{-10t} A   t \geq 0','fontsize',...
    14,'fontname','times')
set(findobj('type','line'),'linewidth',1.5,'markersize',12)
set(findobj('type','axes'),'linewidth',2)
set(findobj('type','axes'),'fontname','times')
```

****

In a separate m-file, `ODE_RK_example1.m`, define the differential equation

****

```
% Differetial eqn for Runge-Kutta Numerical
% First order ODE Solution example (ODE_RK_example1.m)
function dy = ODE_RK_example1(t,y);
dy = -10*y + 5;
```



- Excellent agreement between numerical and analytic results.