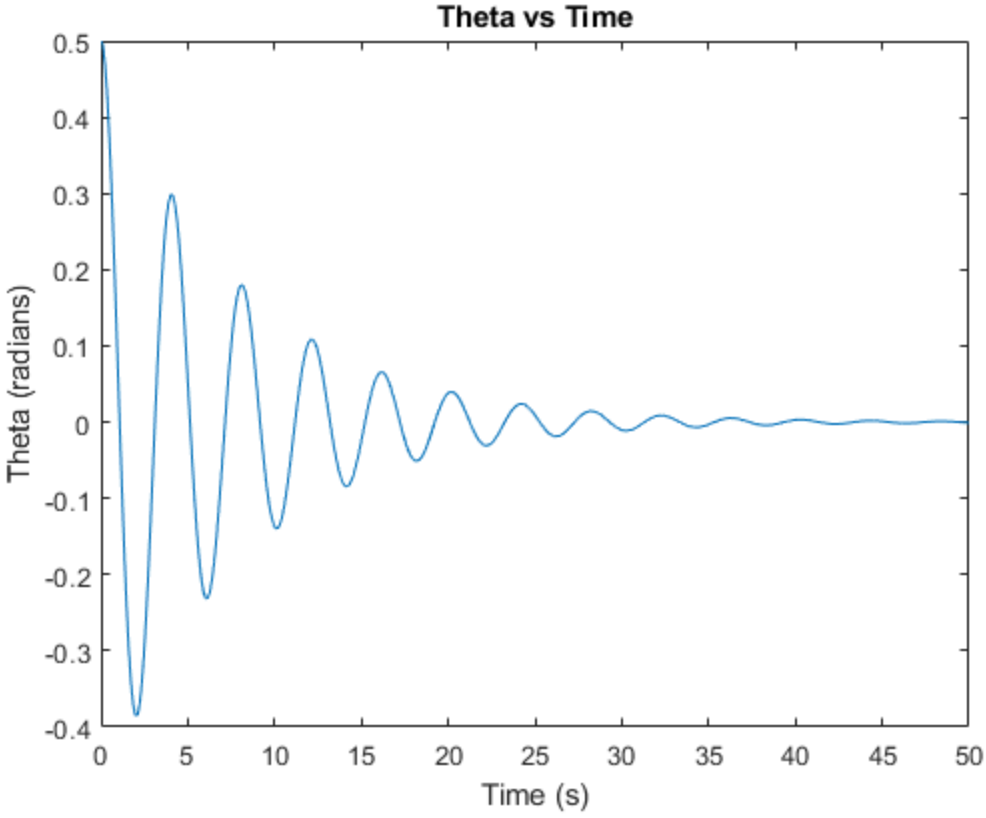
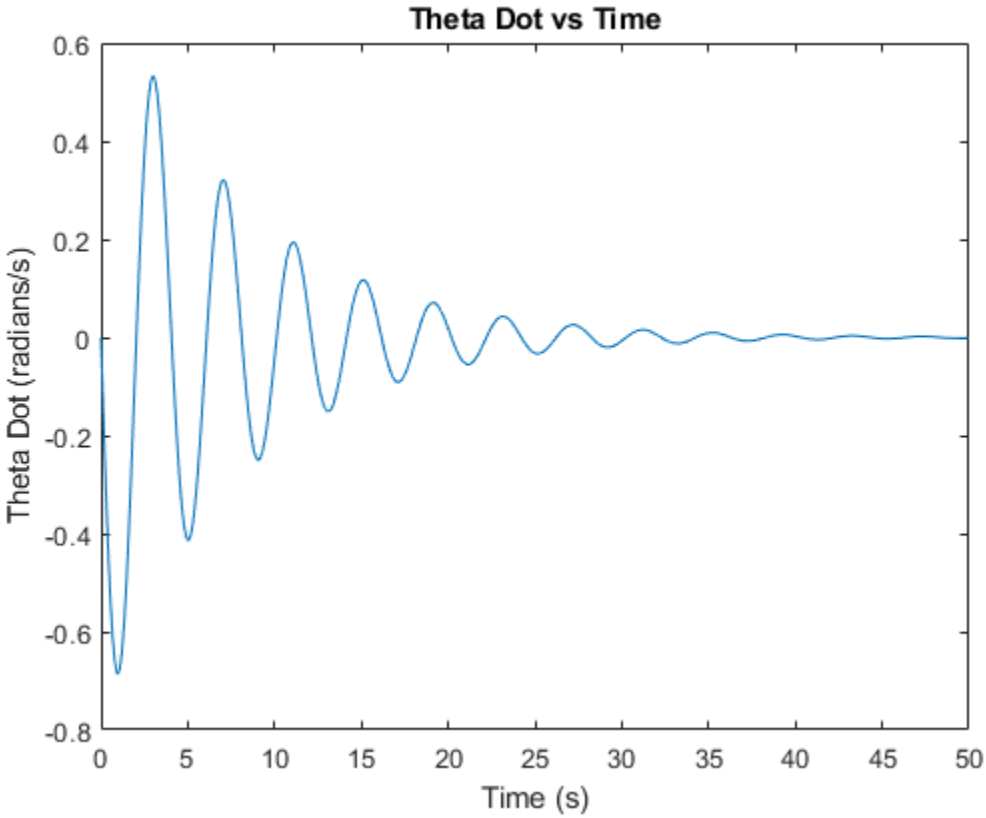
```
clear ; close all ; clc ;
L = 1 ;
p = .25 ;
m = 1 ;
B = .5 ;
g = 9.81 ;
x0 = [ .5 , 0 ] ;
opts = [ 'AbsTol' , 1e-8 , 'RelTol' , 1e-8 ] ;
tspan = [ 0 , 50 ] ;
[ t6 , x6 ] = ode45( @DoublePendulum , tspan , x0 , opts , L , p , m ,
 B , g ) ;
   % Plots
       figure
       plot( t6 , x6(:,1) )
       title( 'Theta vs Time' )
       xlabel( 'Time (s)' )
       ylabel( 'Theta (radians)' )

       figure
       plot( t6 , x6(:,2) )
       title( 'Theta Dot vs Time' )
       xlabel( 'Time (s)' )
       ylabel( 'Theta Dot (radians/s)' )

       figure
       plot( x6(:,1) , x6(:,2) )
       title( 'Theta Dot vs Theta ' )
       xlabel( 'Theta (radians)' )
       ylabel( 'Theta Dot (radians/s)' )

p = -.25:.125:.25 ;

   [ t1 , x1 ] = ode45( @DoublePendulum , tspan , x0 , opts , L ,
p(1) , m , B , g ) ;
   [ t2 , x2 ] = ode45( @DoublePendulum , tspan , x0 , opts , L ,
p(2) , m , B , g ) ;
   [ t3 , x3 ] = ode45( @DoublePendulum , tspan , x0 , opts , L ,
p(3) , m , B , g ) ;
   [ t4 , x4 ] = ode45( @DoublePendulum , tspan , x0 , opts , L ,
p(4) , m , B , g ) ;
   [ t5 , x5 ] = ode45( @DoublePendulum , tspan , x0 , opts , L ,
p(5) , m , B , g ) ;
   % Plots
       figure
       hold on
       plot( t1 , x1(:,1) )
       plot( t2 , x2(:,1) )
       plot( t3 , x3(:,1) )
       plot( t4 , x4(:,1) )
       plot( t5 , x5(:,1) )
       title( 'Theta vs Time' )
       xlabel( 'Time (s)' )
```

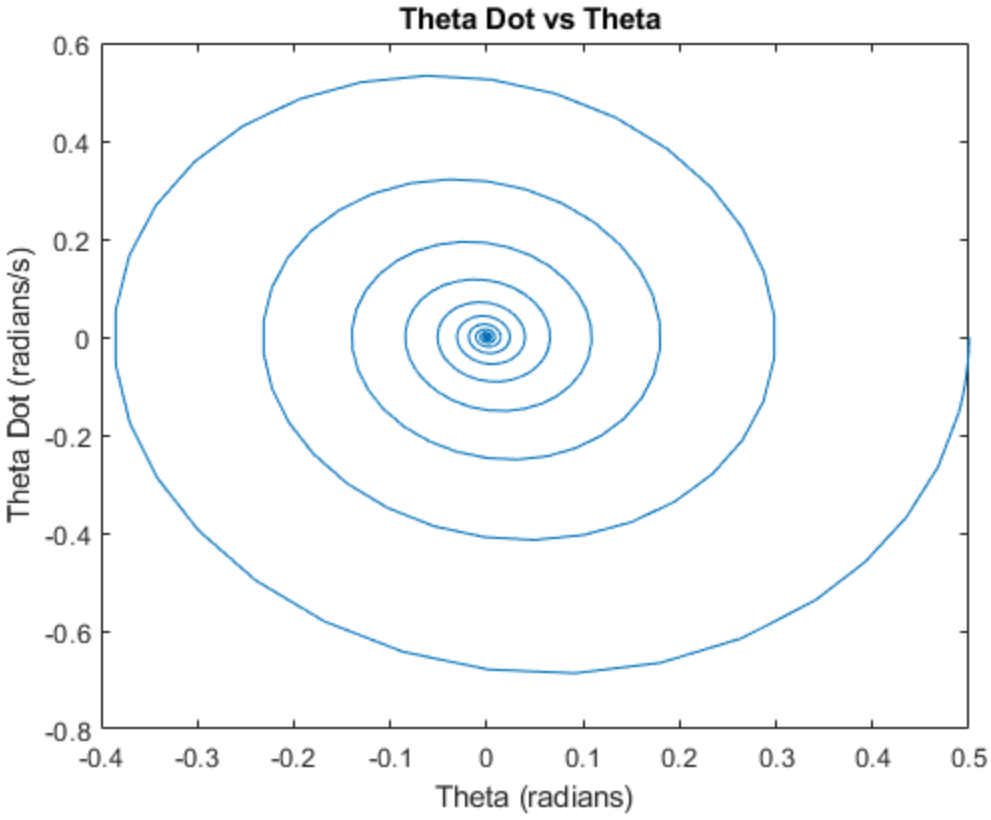
```
        ylabel( 'Theta (radians)' )
        legend( 'p = -.25' , 'p = -.125' , 'p = 0' , 'p = .125' , 'p
= .25' )
        hold off

        figure
        hold on
        plot( t1 , x1(:,2) )
        plot( t2 , x2(:,2) )
        plot( t3 , x3(:,2) )
        plot( t4 , x4(:,2) )
        plot( t5 , x5(:,2) )
        title( 'Theta Dot vs Time' )
        xlabel( 'Time (s)' )
        ylabel( 'Theta Dot (radians/s)' )
        legend( 'p = -.25' , 'p = -.125' , 'p = 0' , 'p = .125' , 'p
= .25' )
        hold off

        figure
        hold on
        plot( x1(:,1) , x1(:,2) )
        plot( x2(:,1) , x2(:,2) )
        plot( x3(:,1) , x3(:,2) )
        plot( x4(:,1) , x4(:,2) )
        plot( x5(:,1) , x5(:,2) )
        title( 'Theta Dot vs Theta' )
        xlabel( 'Theta (radians)' )
        ylabel( 'Theta Dot (radians/s)' )
        legend( 'p = -.25' , 'p = -.125' , 'p = 0' , 'p = .125' , 'p
= .25' )
        hold off
```

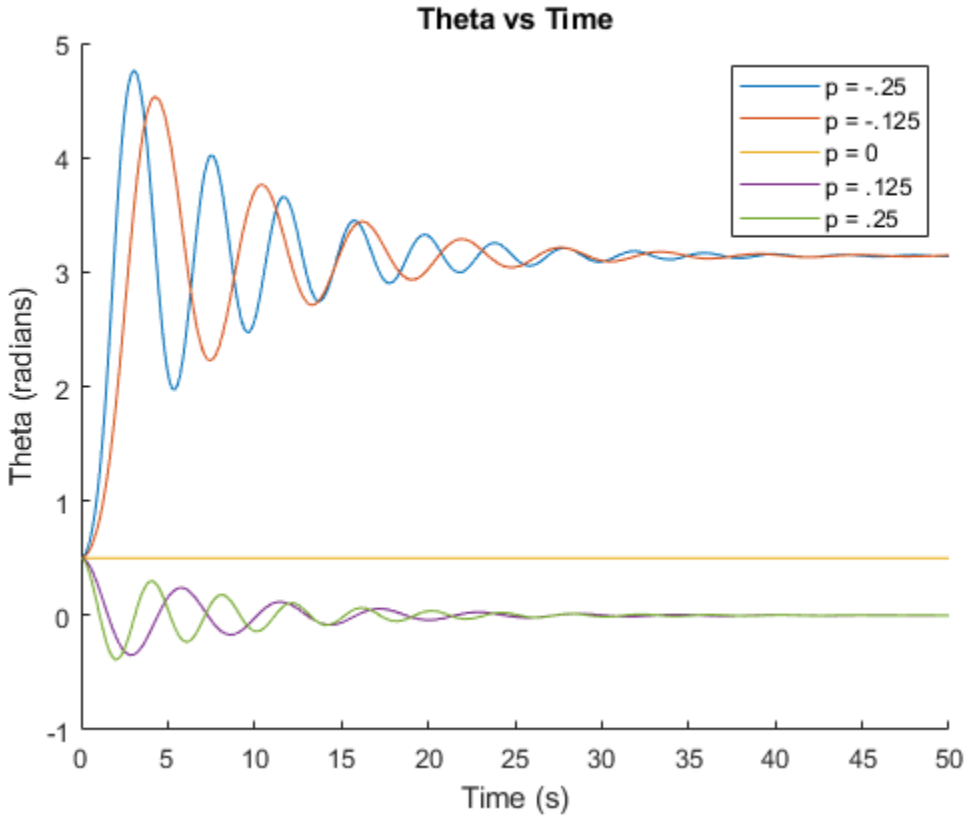
Functions

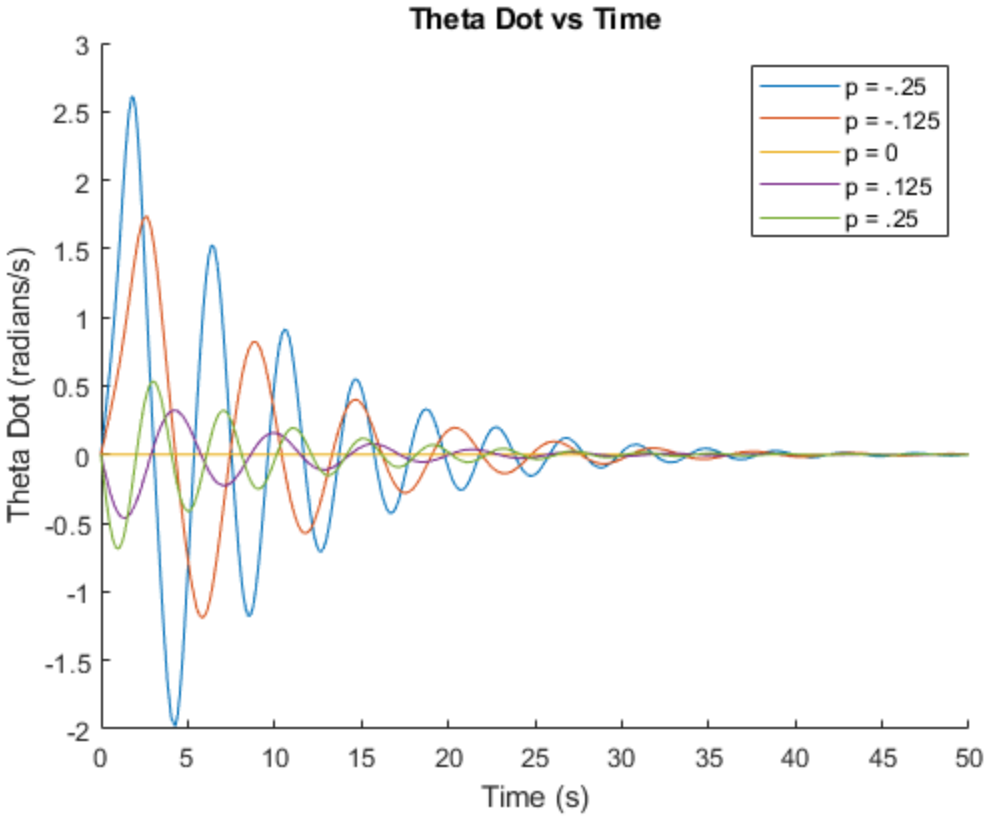
```
function [ dx ] = DoublePendulum( t , x , L , p , m , B , g )
    dx = [ x(2) ; -(B/(2*m*L^2))*x(2) - (g*p/L^2)*sin(x(1)) ] ;
end
```

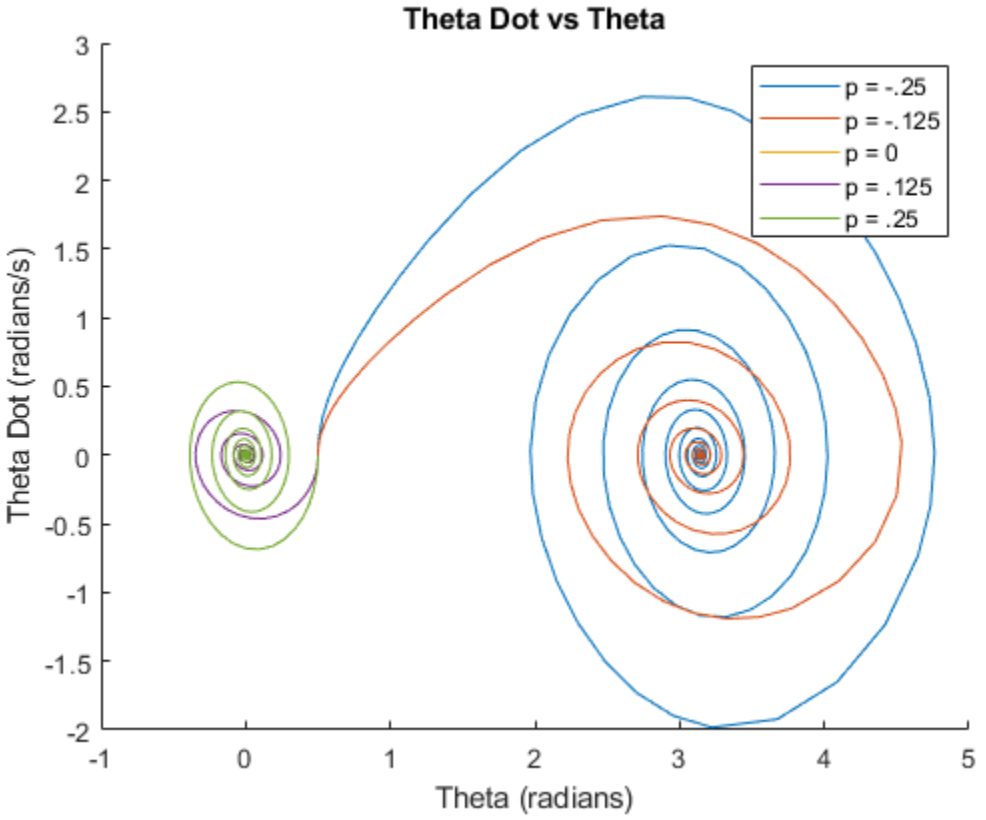

Theta vs Time
Theta (radians)
Time (s)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
0
5
10
15
20
25
30
35
40
45
50


Theta Dot vs Time
Theta Dot (radians/s)
Time (s)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
0
5
10
15
20
25
30
35
40
45
50


Theta Dot vs Theta
Theta Dot (radians/s)
Theta (radians)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
0.5


Theta vs Time
Theta (radians)
Time (s)
p = -.25
p = -.125
p = 0
p = .125
p = .25
5
4
3
2
1
0
-1
0
5
10
15
20
25
30
35
40
45
50


Theta Dot vs Time
Theta Dot (radians/s)
Time (s)
p = -.25
p = -.125
p = 0
p = .125
p = .25
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
5
10
15
20
25
30
35
40
45
50


Theta Dot vs Theta
Theta Dot (radians/s)
Theta (radians)
p = -.25
p = -.125
p = 0
p = .125
p = .25
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-1
0
1
2
3
4
5

Published with MATLAB® R2018b