
Eric Wan - ezw23@drexel.edu - Lab4

Table of Contents

part a	1
part b	1
part c	2
part d	2
part e	4

part a

```
%{  
y'' + (b/m)y' + (k/m)y = f(t) => y'' = f(t) - (b/m)y' - (k/m)y  
y'' = (y')'  
x1 = y, x2 = y', y'' = x2'  
Ax2' + Bx2 + Cx1 = g(t)  
x1' = x2  
x2'(t) = (b/m)x2(t) - (k/m)x1 + f(t)  
[x1; x2]' = [0 1; -(k/m) (b/m)][x1; x2] + [0; f(t)]  
%}
```

part b

```
type d2ydt2.m  
b = 8  
y = d2ydt2(0, b)  
y = d2ydt2(50, b)  
y = d2ydt2(-20, b)  
%{  
changing f(t) shifts equilibrium point in that direction  
increasing f(t) shifts right, decreasing f(t) shifts left  
%}
```

```
function [ y ] = d2ydt2( f, b )  
d2y = 0;  
dy = 0;  
k = 200;  
m = 1;  
y = (f - d2y - (b/m)*dy) / (k/m);  
end
```

b =

8

```
y =  
  
0  
  
y =  
  
0.2500  
  
y =  
  
-0.1000
```

part c

```
%{  
f(t) = y'' + 8y' + 200y  
Aux = r^2 + 8r + 200  
%}  
Aux = [1 8 200];  
rootsAux = roots(Aux)  
%{  
roots are complex b/c determinant (b^2 - 4ac) is less than 0  
%}  
checkRootsAux = (Aux(2))^2 - 4*(Aux(1))*(Aux(3))  
  
rootsAux =  
  
-4.0000 +13.5647i  
-4.0000 -13.5647i  
  
checkRootsAux =  
  
-736
```

part d

```
figure  
tI = 0;  
tEnd = 2;  
tSpan = [tI tEnd];  
yI = 63;  
dyI = 0;  
ySpan = [yI; dyI];  
type dyode.m
```

```
[tode, yode] = ode45(@dyode, tSpan, ySpan);
subplot(2,2,1)
plot(tode,yode(:,1))
grid on
hold on
xlabel('Interval Range (t)')
ylabel('Y(t)')
title('Y(t) vs. t')

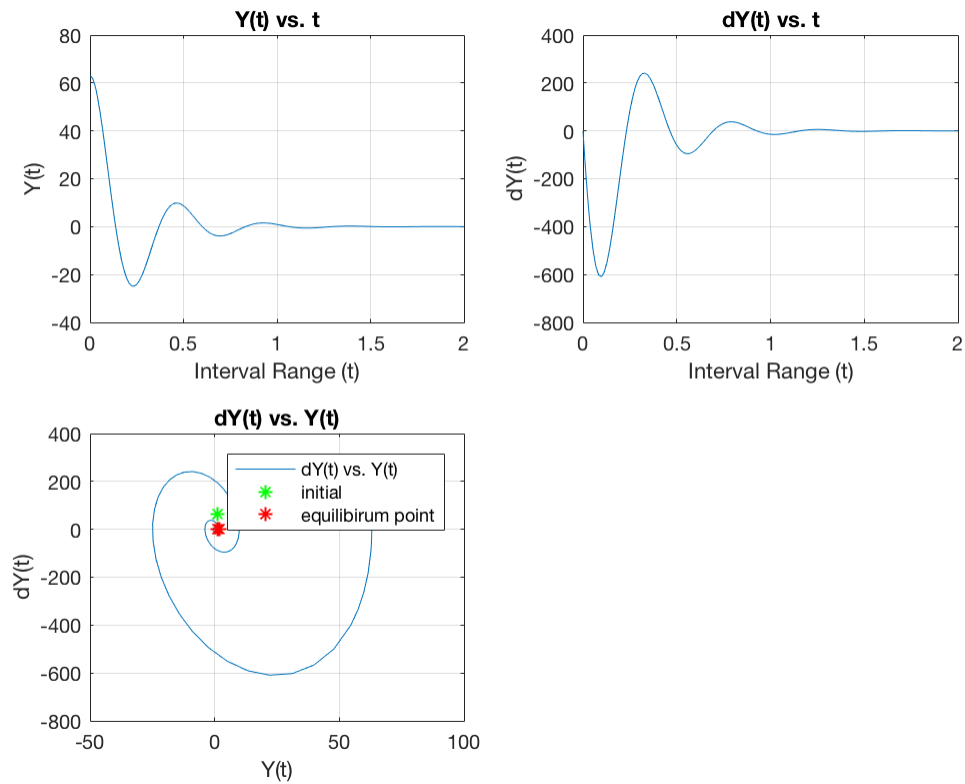
subplot(2,2,2)
plot(tode,yode(:,2))
grid on
hold on
xlabel('Interval Range (t)')
ylabel('dY(t)')
title('dY(t) vs. t')

subplot(2,2,3)
plot(yode(:,1),yode(:,2))
grid on
hold on
xlabel('Y(t)')
ylabel('dY(t)')
title('dY(t) vs. Y(t)')

points = [yode(1,1) yode(1,2); yode(164,1) yode(164,2)];
plot(points(1,:), 'g*' )
plot(points(2,:), 'r*' )
legend('dY(t) vs. Y(t)', 'initial', 'equilibirum point')

function [ yode ] = dyode( tSpan, ySpan )
b = 8;
k = 200;
m = 1;
f = 0;
yode = [0 1; -(k/m) -(b/m)]*ySpan + [0; f];

end
```



part e

```
%{
b^2 - 4ac = 0
b^2 = 4(1)(200)
%}
b = sqrt(4*200);
Aux = [1 b 200];
rootsAux = roots(Aux)

figure
tI = 0;
tEnd = 2;
tSpan = [tI tEnd];
yI = 63;
dyI = 0;
ySpan = [yI; dyI];
type dyode.m
[tode, yode] = ode45(@dyodeNew, tSpan, ySpan);
subplot(2,2,1)
plot(tode,yode(:,1))
grid on
hold on
xlabel('Interval Range (t)')
ylabel('Y(t)')
```

```
title('New Y(t) vs. t')

subplot(2,2,2)
plot(tode,yode(:,2))
grid on
hold on
xlabel('Interval Range (t)')
ylabel('dY(t)')
title('New dY(t) vs. t')

subplot(2,2,3)
plot(yode(:,1),yode(:,2))
grid on
hold on
xlabel('Y(t)')
ylabel('dY(t)')
title('New dY(t) vs. Y(t)')

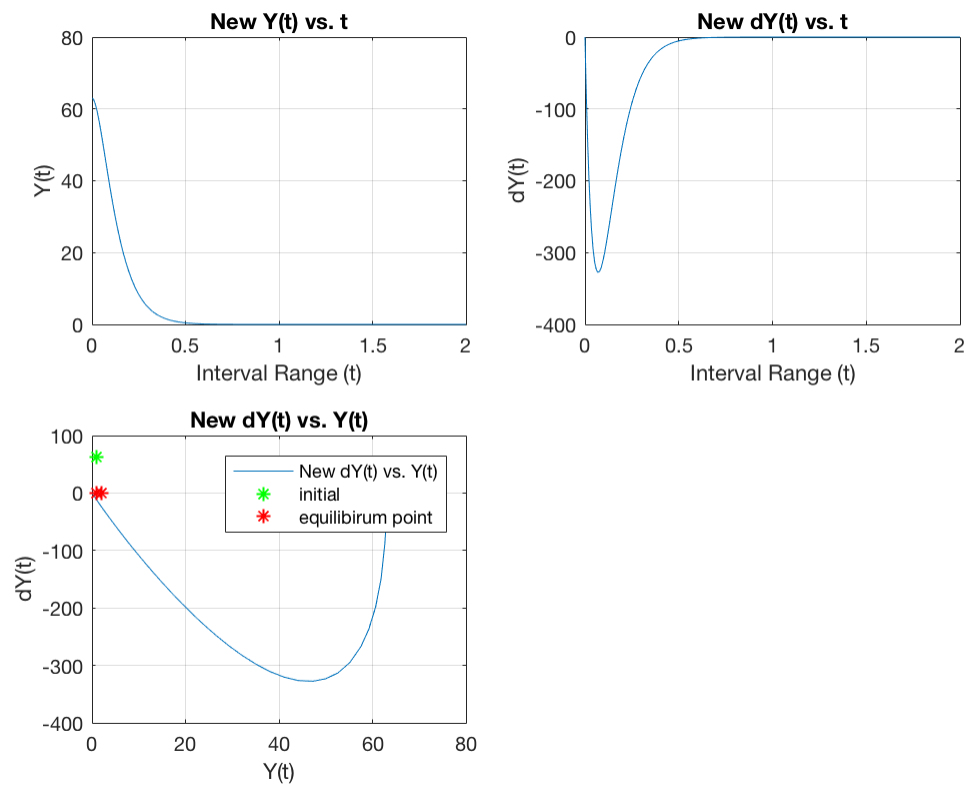
points = [yode(1,1) yode(1,2); yode(145,1) yode(145,2)];
plot(points(1,:), 'g*')
plot(points(2,:), 'r*')
legend('New dY(t) vs. Y(t)', 'initial', 'equilibrium point')
%{
Time is faster to get to get to equilibrium with the new B value
%}

rootsAux =

    -14.1421
    -14.1421

function [ yode ] = dyode( tSpan, ySpan )
b = 8;
k = 200;
m = 1;
f = 0;
yode = [0 1; -(k/m) -(b/m)]*ySpan + [0; f];

end
```



Published with MATLAB® R2017a