
Yizhan Ao and Yisheng Leng Matlab project 4

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Problem 10 Part A

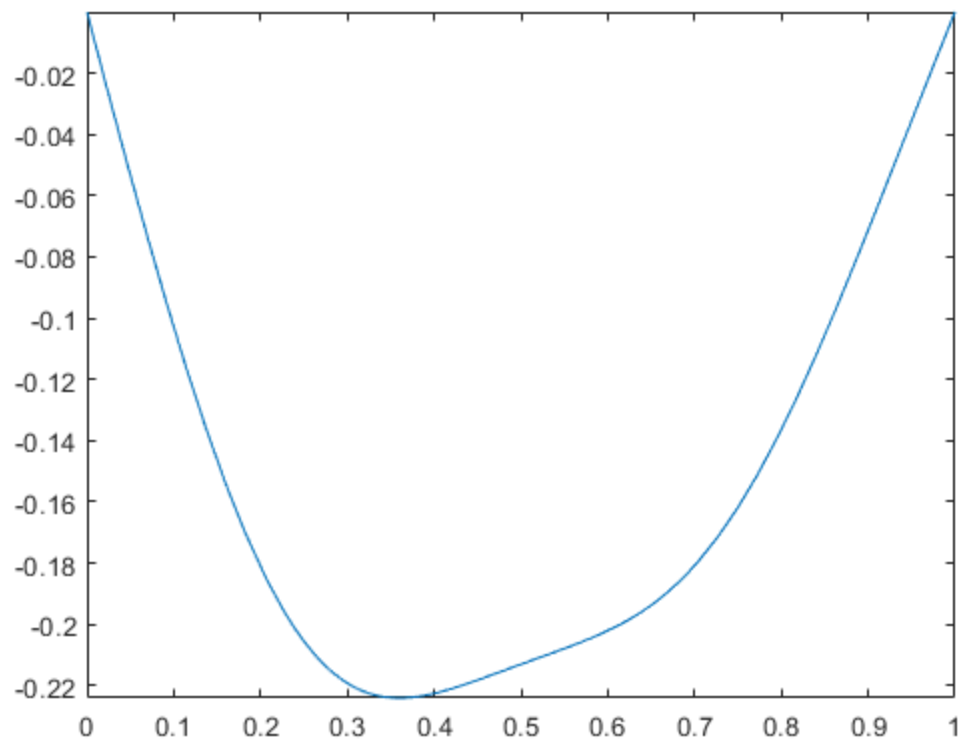
```
syms u(x)
M = 5*(sin(2*(pi)*x))^2/(exp(x) + 1) - exp(x)*u(2)/(exp(x) + 1);
ode = (x+1)*diff(u,x,2)+diff(u,1) == 5*(sin(2*pi*x))^2
dsolve(ode, u(0)==0,u(1)==0)
fplot(ans,[0,1])

ode(x) =

(x + 1)*diff(u(x), x, x) + diff(u(x), x) == 5*sin(2*pi*x)^2

ans =

-((log(x + 1)*ei(-pi*4i) - log(x + 1)*ei(pi*4i) + log(2)*ei(-pi*(x
+ 1)*4i) - log(2)*ei(pi*(x + 1)*4i) - log(x + 1)*ei(-pi*8i) + log(x
+ 1)*ei(pi*8i) - log(2)*ei(-pi*4i) + log(2)*ei(pi*4i) - pi*log(x +
1)*8i + pi*x*log(2)*8i)*5i)/(16*pi*log(2))
```



Problem 10 Part B

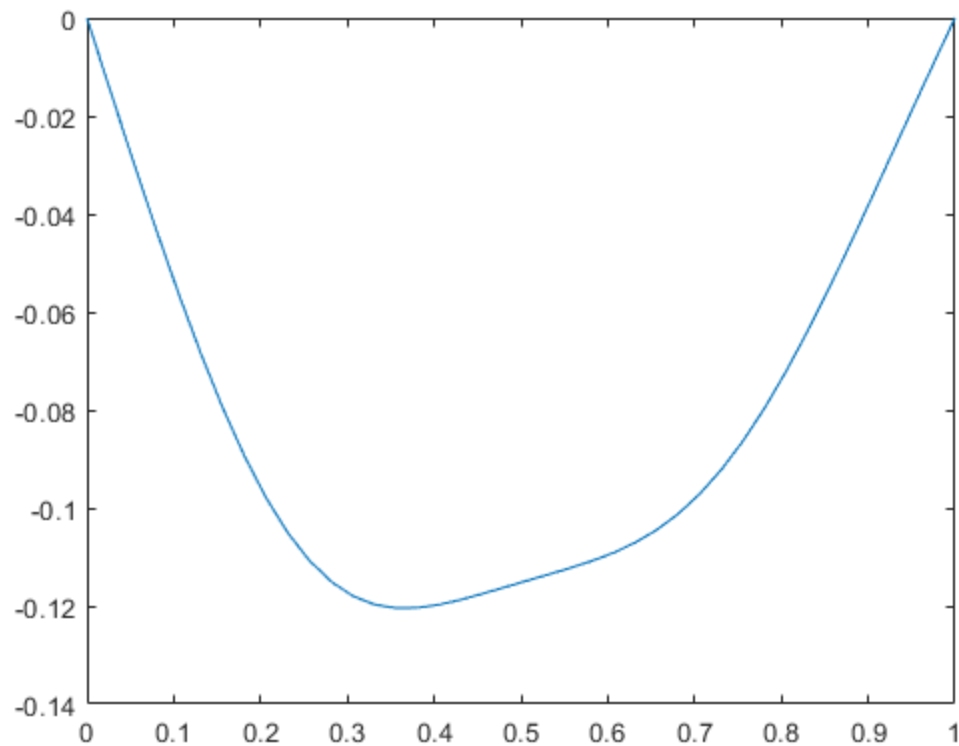
```
rhs=@(x,u) [u(2); 5*(sin(2*(pi)*x))^2/(exp(x) + 1) - exp(x)*u(2)/  
    (exp(x) + 1)]  
[ta, ya] = ode45(rhs, [0 1], [0 -0.5564]);  
r = ya(end, 1);  
plot(ta, ya(:,1))
```

%The maximum displacement is occuring when 0.3-0.4

rhs =

function_handle with value:

```
@(x,u)[u(2);5*(sin(2*(pi)*x))^2/(exp(x)+1)-exp(x)*u(2)/(exp(x)+1)]
```



Problem 10 Part C

```
rhs2 = @(x,y)[y(2); 5*(sin(2*pi*x))^2/(exp(x)+1)-exp(x)*y(2)/  
(exp(x)+1)]  
init = bvpinit(0 : 0.1: 1, [0 0]);  
cond = @(ya,yb) [ya(1); yb(1)];  
solu = bvp4c (rhs2, cond,init);  
xx = 0: 0.03:1;  
yy = deval(solu, xx)  
plot(xx,yy(1,:))
```

rhs2 =

function_handle with value:

```
@(x,y)[y(2);5*(sin(2*pi*x))^2/(exp(x)+1)-exp(x)*y(2)/(exp(x)+1)]
```

yy =

Columns 1 through 7

0	-0.0166	-0.0328	-0.0484	-0.0633	-0.0768	-0.0889
-0.5564	-0.5472	-0.5330	-0.5099	-0.4753	-0.4288	-0.3714

Columns 8 through 14

-0.0991	-0.1072	-0.1133	-0.1173	-0.1196	-0.1205	-0.1202
-0.3061	-0.2367	-0.1681	-0.1046	-0.0501	-0.0071	0.0233

Columns 15 through 21

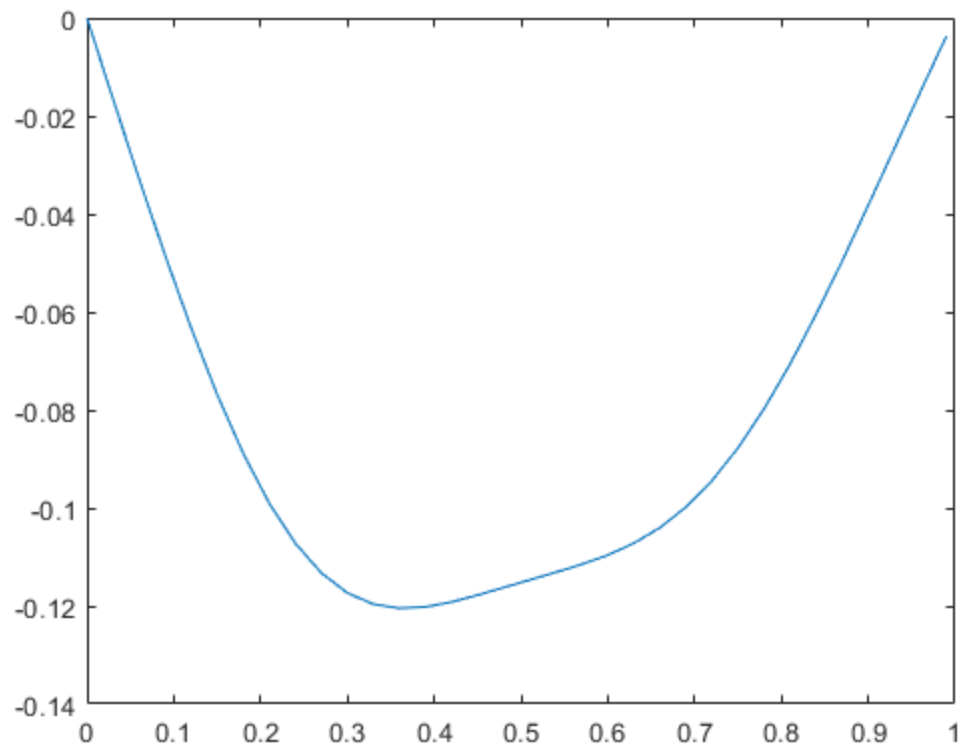
-0.1192	-0.1178	-0.1162	-0.1147	-0.1131	-0.1115	-0.1096
0.0417	0.0503	0.0523	0.0515	0.0521	0.0574	0.0702

Columns 22 through 28

-0.1072	-0.1040	-0.0998	-0.0944	-0.0878	-0.0798	-0.0706
0.0917	0.1217	0.1590	0.2010	0.2445	0.2862	0.3228

Columns 29 through 34

-0.0605	-0.0496	-0.0382	-0.0267	-0.0151	-0.0037	
0.3520	0.3722	0.3834	0.3863	0.3829	0.3758	



Problem 15 Part A

```
figure;  
hold on
```

```
p=ezplot(dsolve('D2u + u = 3*cos(.5*t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
q=ezplot(dsolve('D2u + u = 3*cos(.6*t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
r=ezplot(dsolve('D2u + u = 3*cos(.7*t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
s=ezplot(dsolve('D2u + u = 3*cos(.8*t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
t=ezplot(dsolve('D2u + u = 3*cos(.9*t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
set(p);
set(q);
set(r);
set(s);
set(t);
axis([0 15 -20 20]);
xlabel('Time'), ylabel('Displacement')
title 'Q 15 Part A'
hold off
```

```
% The different plots for the different values for w. When w is
    getting
% closer to w0, the amplitude of the waves starts to change
    drastically.
```

Warning: Support of character vectors and strings will be removed in a future release. Use sym objects to define differential equations instead.

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```
AlignVertexCenters: {[on] [off]}
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    ButtonDownFcn: {}
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        Clipping: {[on] [off]}
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    Interruptible: {[on] [off]}
```

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AlignVertexCenters: {[on] [off]}
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        MarkerFaceColor: {'auto' 'none'}
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        MarkerMode: {'auto' 'manual'}
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        SelectionHighlight: {[on] [off]}
```

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    YData: {}
    YDataSource: {}
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    ZDataSource: {}

AlignVertexCenters: {[on] [off]}
    BusyAction: {'queue' 'cancel'}
    ButtonDownFcn: {}
    Children: {}
    Clipping: {[on] [off]}
    Color: {1x0 cell}
    ColorMode: {'auto' 'manual'}
    ContextMenu: {}
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    DeleteFcn: {}
    DisplayName: {}
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    HitTest: {[on] [off]}
    Interruptible: {[on] [off]}
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    LineStyle: {'-' '--' ':' '-.' 'none'}
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    MarkerFaceColor: {'auto' 'none'}
    MarkerIndices: {}
    MarkerMode: {'auto' 'manual'}
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    SelectionHighlight: {[on] [off]}
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    Visible: {[on] [off]}
    XData: {}
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    XDataSource: {}
    YData: {}
    YDataSource: {}
    ZData: {}
    ZDataSource: {}

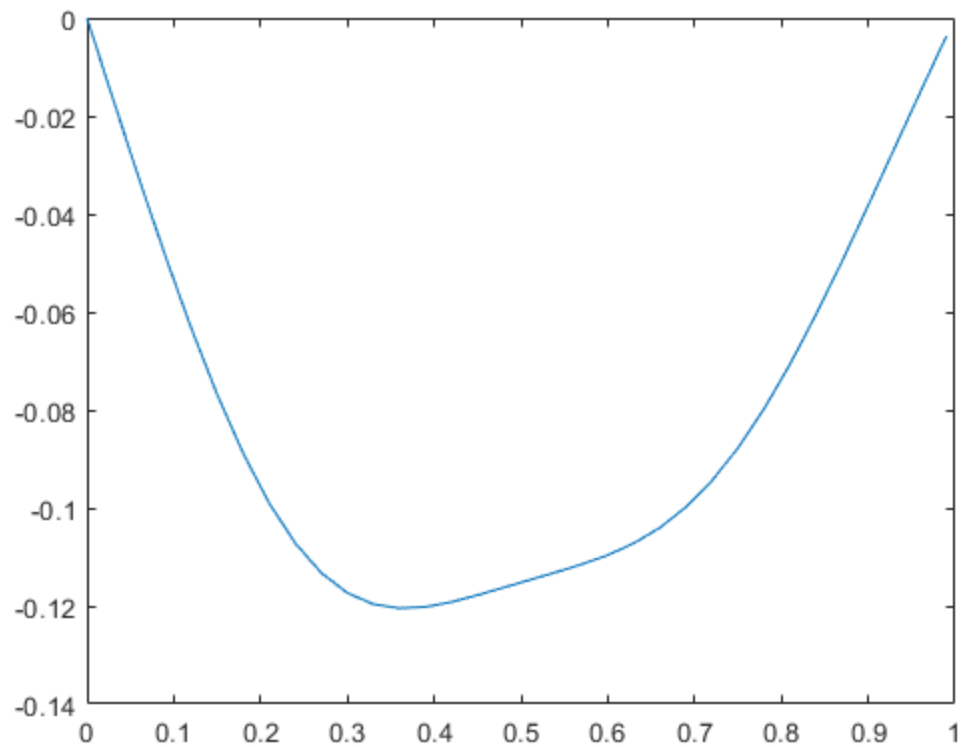
AlignVertexCenters: {[on] [off]}
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```

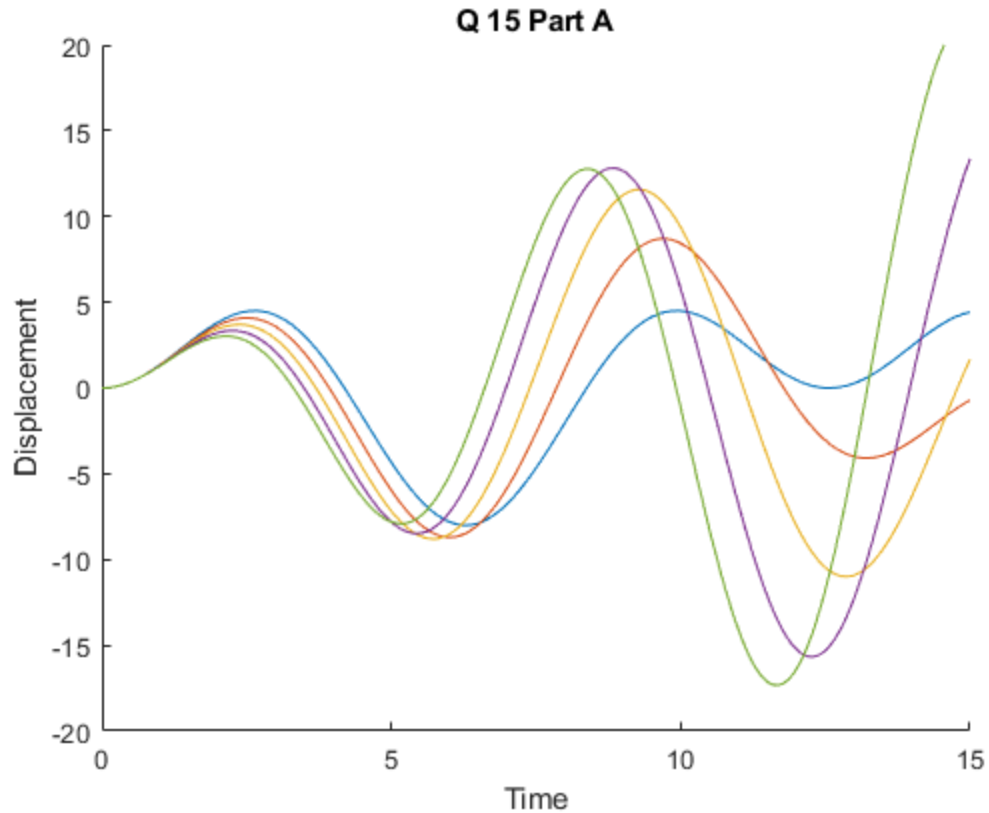
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ContextMenu: {}
CreateFcn: {}
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DisplayName: {}
HandleVisibility: {'on' 'callback' 'off'}
HitTest: {[on] [off]}
Interruptible: {[on] [off]}
LineJoin: {'chamfer' 'miter' 'round'}
LineStyle: {'-' '--' ':' '-.' 'none'}
LineStyleMode: {'auto' 'manual'}
LineWidth: {}
Marker: {1x16 cell}
MarkerEdgeColor: {'auto' 'none'}
MarkerFaceColor: {'auto' 'none'}
MarkerIndices: {}
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MarkerSize: {}
Parent: {}
PickableParts: {'visible' 'none' 'all'}
Selected: {[on] [off]}
SelectionHighlight: {[on] [off]}
SeriesIndex: {}
Tag: {}
UserData: {}
Visible: {[on] [off]}
XData: {}
XDataMode: {'auto' 'manual'}
XDataSource: {}
YData: {}
YDataSource: {}
ZData: {}
ZDataSource: {}

AlignVertexCenters: {[on] [off]}
BusyAction: {'queue' 'cancel'}
ButtonDownFcn: {}
Children: {}
Clipping: {[on] [off]}
Color: {1x0 cell}
ColorMode: {'auto' 'manual'}
ContextMenu: {}
CreateFcn: {}
DeleteFcn: {}
DisplayName: {}
HandleVisibility: {'on' 'callback' 'off'}
HitTest: {[on] [off]}
Interruptible: {[on] [off]}
LineJoin: {'chamfer' 'miter' 'round'}
LineStyle: {'-' '--' ':' '-.' 'none'}
```



```
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MarkerIndices: {}  
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Parent: {}  
PickableParts: {'visible' 'none' 'all'}  
Selected: {[on] [off]}  
SelectionHighlight: {[on] [off]}  
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Tag: {}  
UserData: {}  
Visible: {[on] [off]}  
XData: {}  
XDataMode: {'auto' 'manual'}  
XDataSource: {}  
YData: {}  
YDataSource: {}  
ZData: {}  
ZDataSource: {}
```





Problem 15 Part B

```
figure;
% equ == 'D2u + u = 3*cos(t)';
p = ezplot(dsolve('D2u + u = 3*cos(t)', 'u(0) = 0', 'Du(0) = 0'), [0
15]);
set(p);
xlabel('Time'), ylabel('Displacement')
title 'Interval [0 15]'
```

```
figure;
q = ezplot(dsolve('D2u + u = 3*cos(t)', 'u(0) = 0', 'Du(0) = 0'), [0
30]);
set(q);
xlabel('Time'), ylabel('Displacement')
title 'Interval [0 30]'
```

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release. Use sym objects to define differential equations instead.

```
AlignVertexCenters: {[on] [off]}
BusyAction: {'queue' 'cancel'}
ButtonDownFcn: {}
Children: {}
Clipping: {[on] [off]}
Color: {1x0 cell}
```

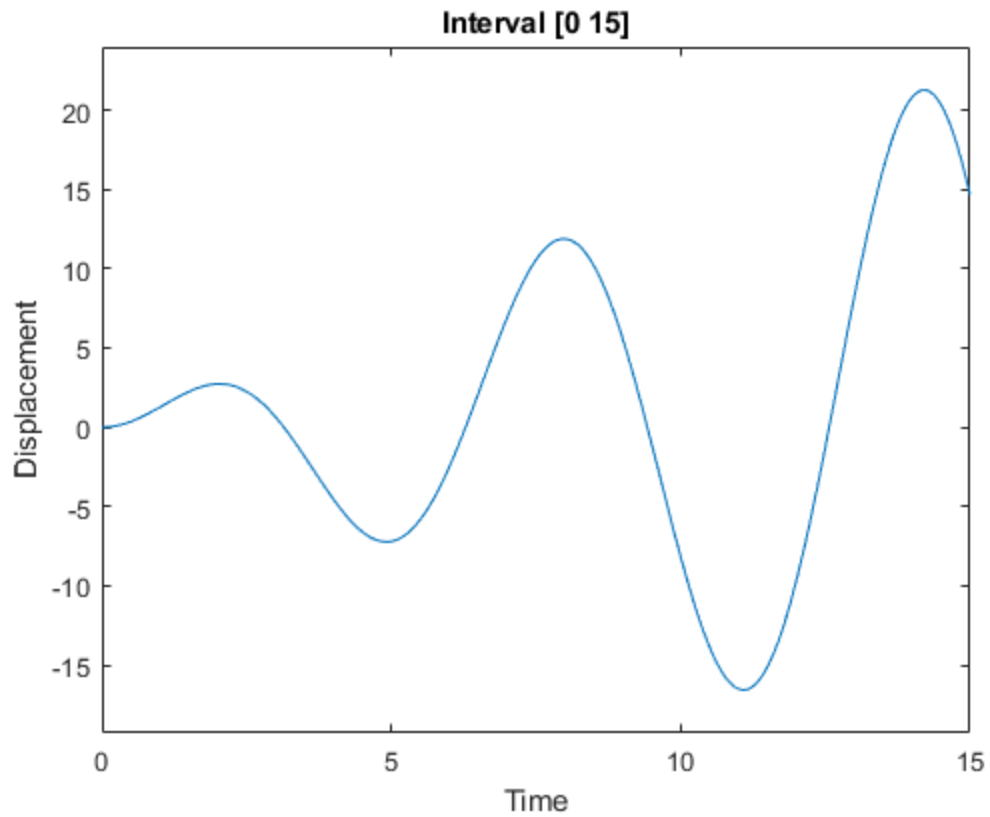
```
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    Interruptible: {[on] [off]}
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        LineStyle: {'-' '--' ':' '-.' 'none'}
    LineStyleMode: {'auto' 'manual'}
    LineWidth: {}
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    MarkerFaceColor: {'auto' 'none'}
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    UserData: {}
    Visible: {[on] [off]}
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    XDataSource: {}
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    YDataSource: {}
    ZData: {}
    ZDataSource: {}
```

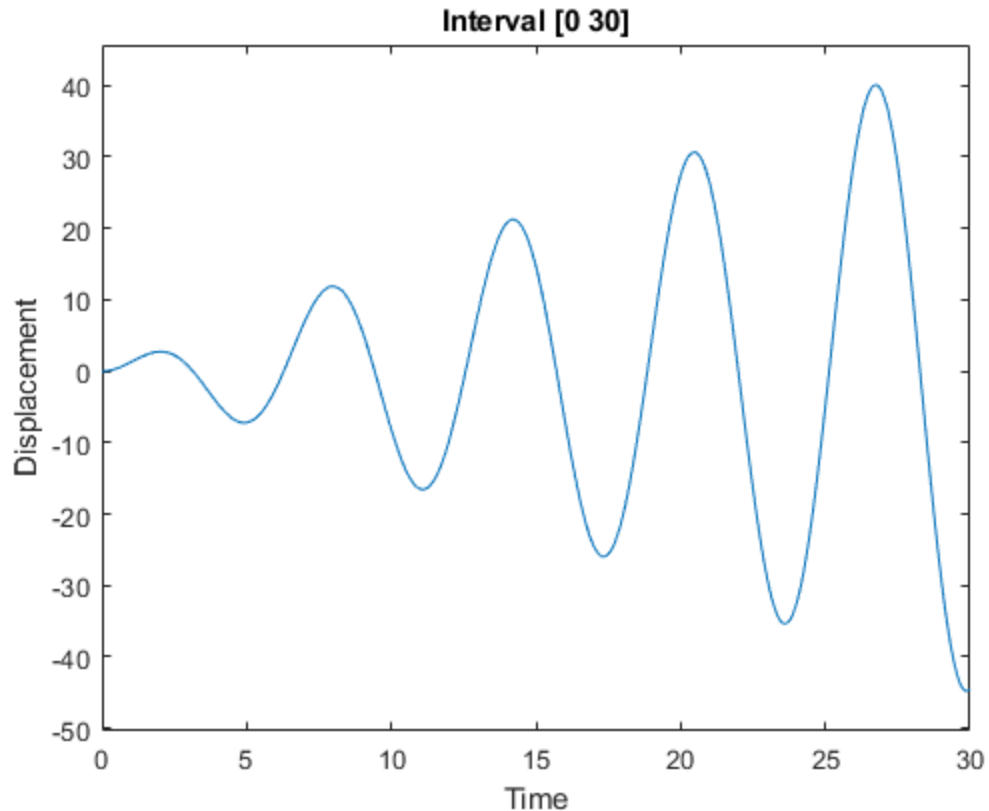
Warning: Support of character vectors and strings will be removed in a future

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```
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    BusyAction: {'queue' 'cancel'}
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XData: {}  
XDataMode: {'auto' 'manual'}  
XDataSource: {}  
YData: {}  
YDataSource: {}  
ZData: {}  
ZDataSource: {}
```





Problem 15 Part C

```
figure;  
hold on  
p=ezplot(dsolve('D2u + u = 3*cos(.9*t)', 'u(0) = 0', 'Du(0) = 0'), [0  
    120]);  
set(p);  
xlabel t, ylabel y  
title 'Interval [0 30]'
```

```
q = ezplot(dsolve('D2u + u = 3*cos(t)', 'u(0) = 0', 'Du(0) = 0'), [0  
    120]);  
set(q);  
xlabel('Time'), ylabel('Displacement')  
title 'Interval [0 30]'  
hold off
```

% This occurs when there is a periodic change in the amplitude which
% is known as a beat in modifying the amplitude modulation.

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AlignVertexCenters: {[on] [off]}

BusyAction: {'queue' 'cancel'}

ButtonDownFcn: {}

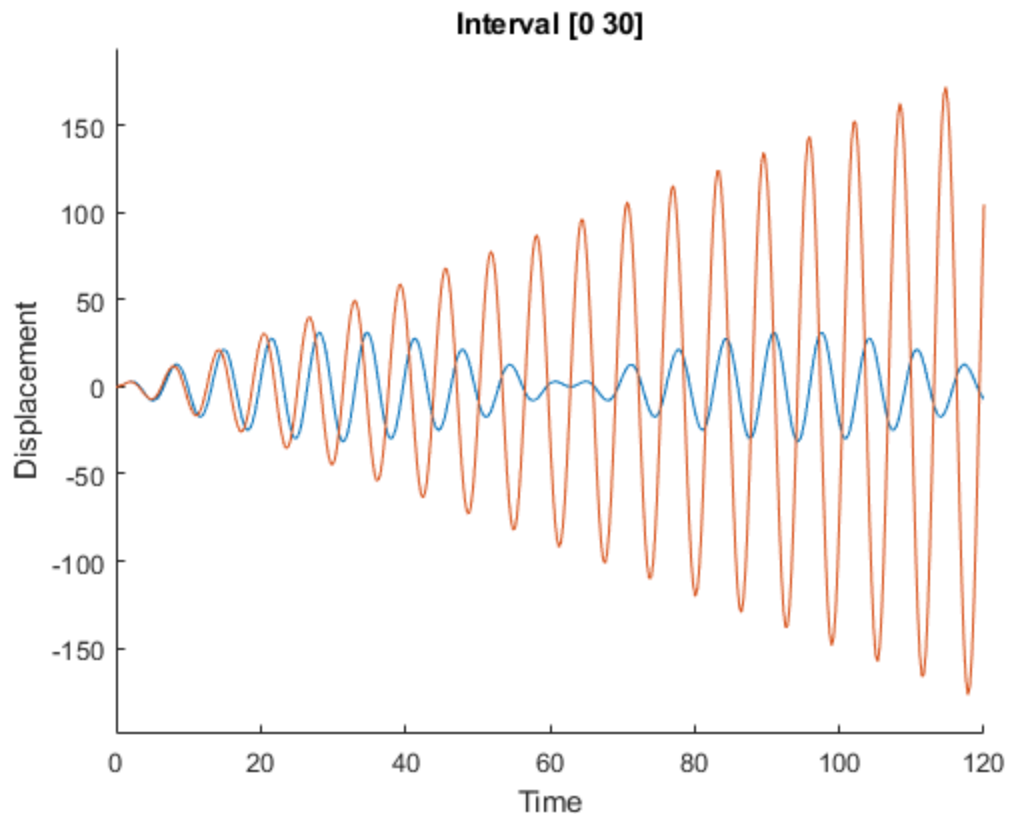
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HitTest: {[on] [off]}
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ZDataSource: {}
```

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```
AlignVertexCenters: {[on] [off]}
BusyAction: {'queue' 'cancel'}
ButtonDownFcn: {}
Children: {}
Clipping: {[on] [off]}
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CreateFcn: {}
DeleteFcn: {}
DisplayName: {}
HandleVisibility: {'on' 'callback' 'off'}
HitTest: {[on] [off]}
Interruptible: {[on] [off]}
```

```
LineJoin: {'chamfer' 'miter' 'round'}  
LineStyle: {'-' '--' ':' '-.' 'none'}  
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YData: {}  
YDataSource: {}  
ZData: {}  
ZDataSource: {}
```



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