Yizhan Ao and Yisheng Leng Matlab project 4

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Problem 10 Part A

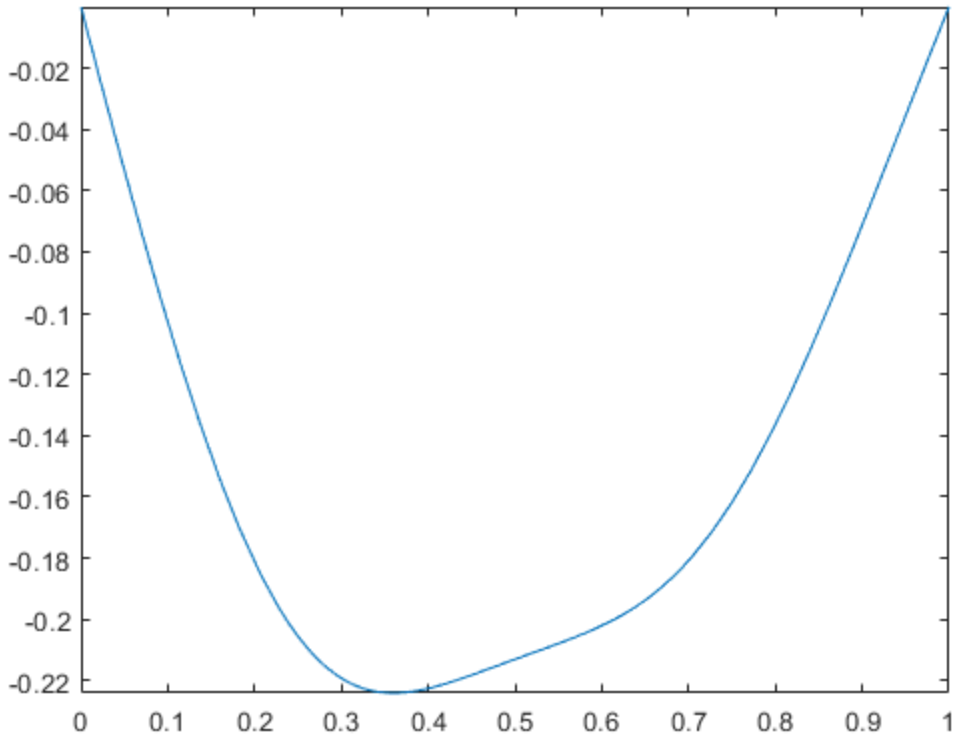
```
syms u(x)
M = 5*(sin(2*(pi)*x))^2/(exp(x) + 1) - exp(x)*u(2)/ (exp(x) + 1);
ode = (x+1)*diff(u,x,2)+diff(u,1) == 5*(sin(2*pi*x))^2
dsolve(ode, u(0)==0,u(1)==0)
fplot(ans,[0,1])
```

```
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

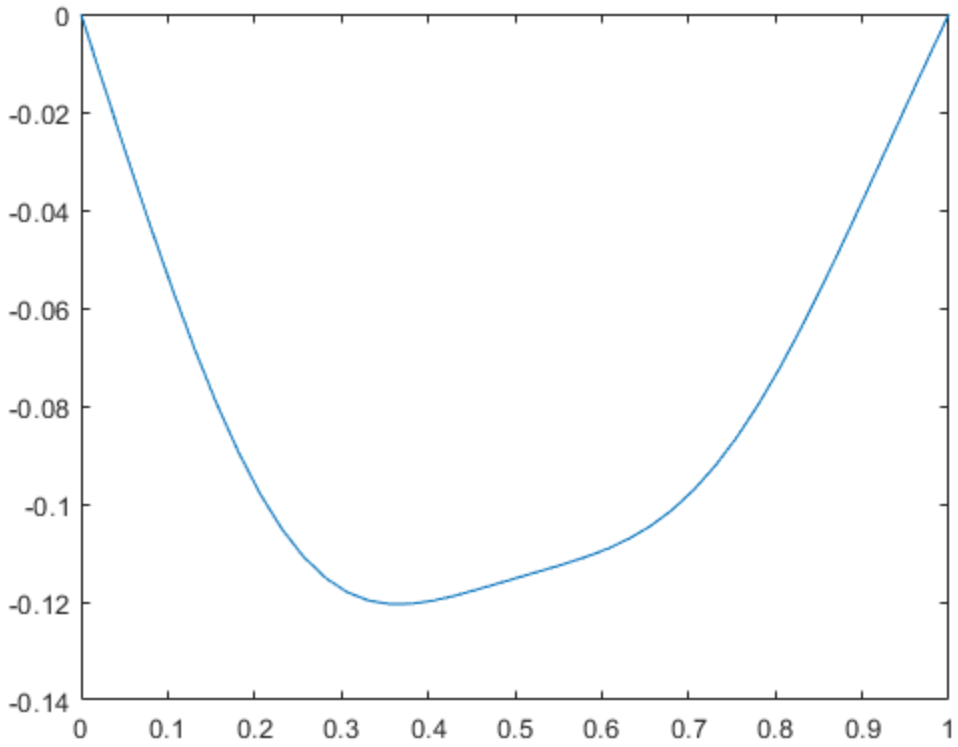
```
rhs=@(x,u) [u(2); 5*(sin(2*(pi)*x))^2/(exp(x) + 1) - exp(x)*u(2)/
 (exp(x) + 1)]
[ta, ya] = ode45(rhs, [0 1], [0 -0.5564]);
r = ya(end, 1);
plot(ta, ya(:,1))

%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

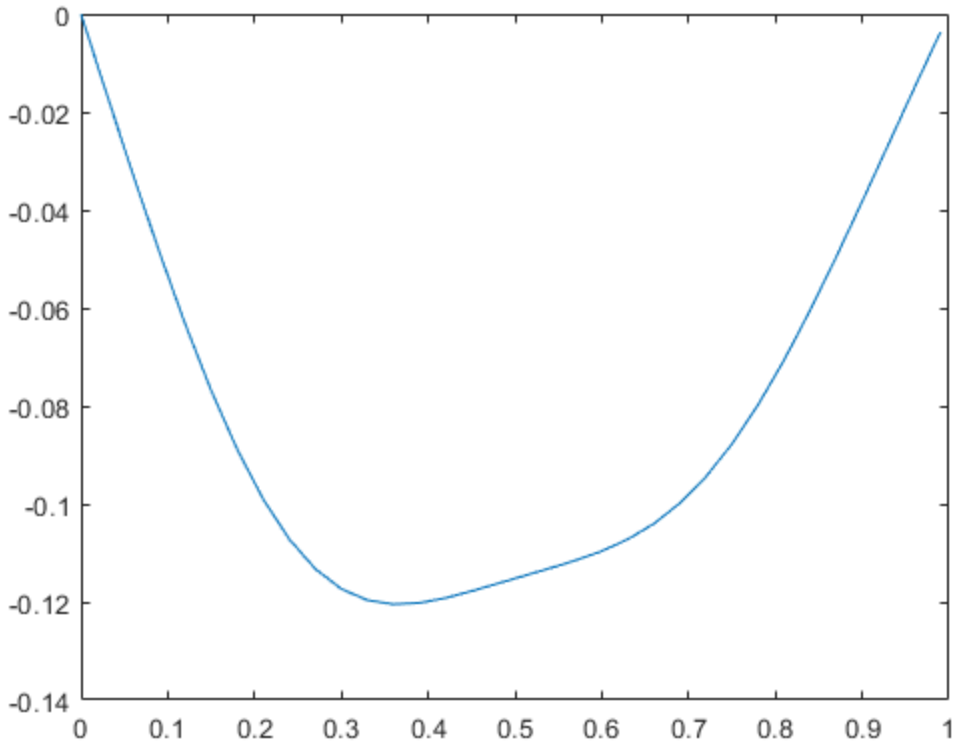
 -0.1192   -0.1178   -0.1162   -0.1147   -0.1131   -0.1115   -0.1096
  0.0417    0.0503    0.0523    0.0515    0.0521    0.0574    0.0702

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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release. Use sym objects to define differential equations instead.
    AlignVertexCenters: {[on]  [off]}
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        ZDataSource: {}

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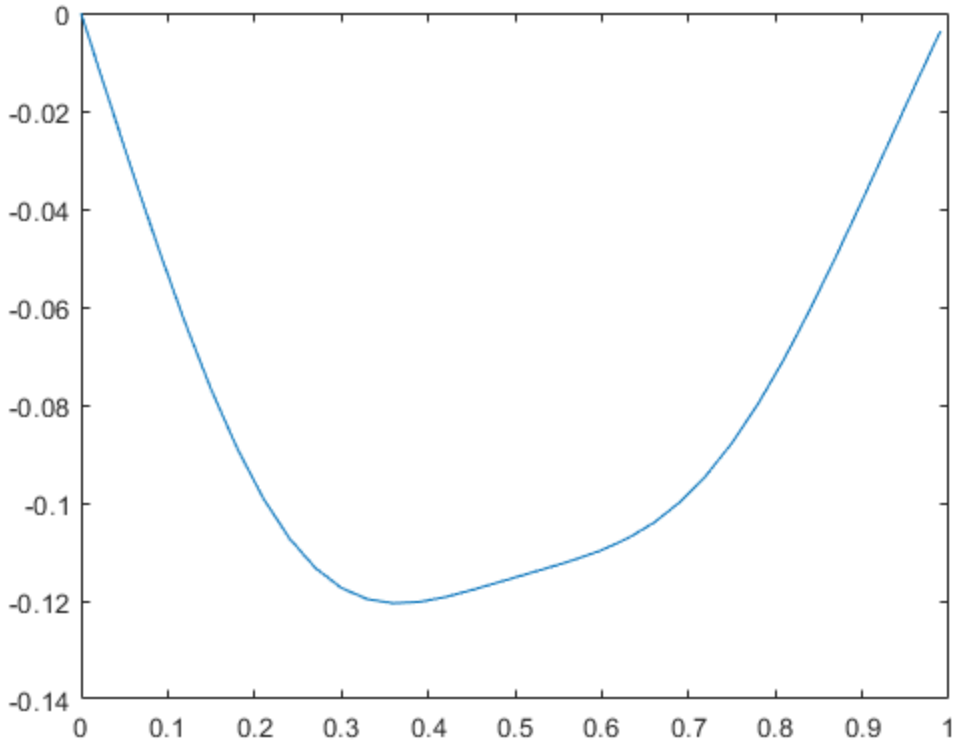

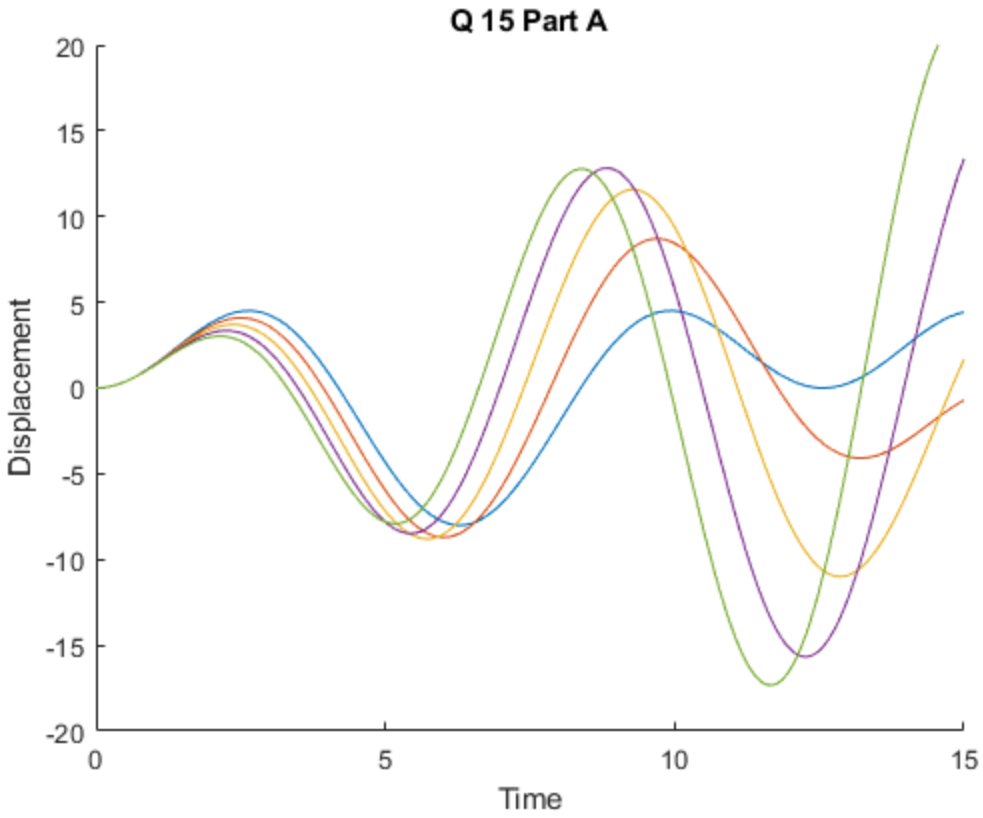

Problem 15 Part B

```
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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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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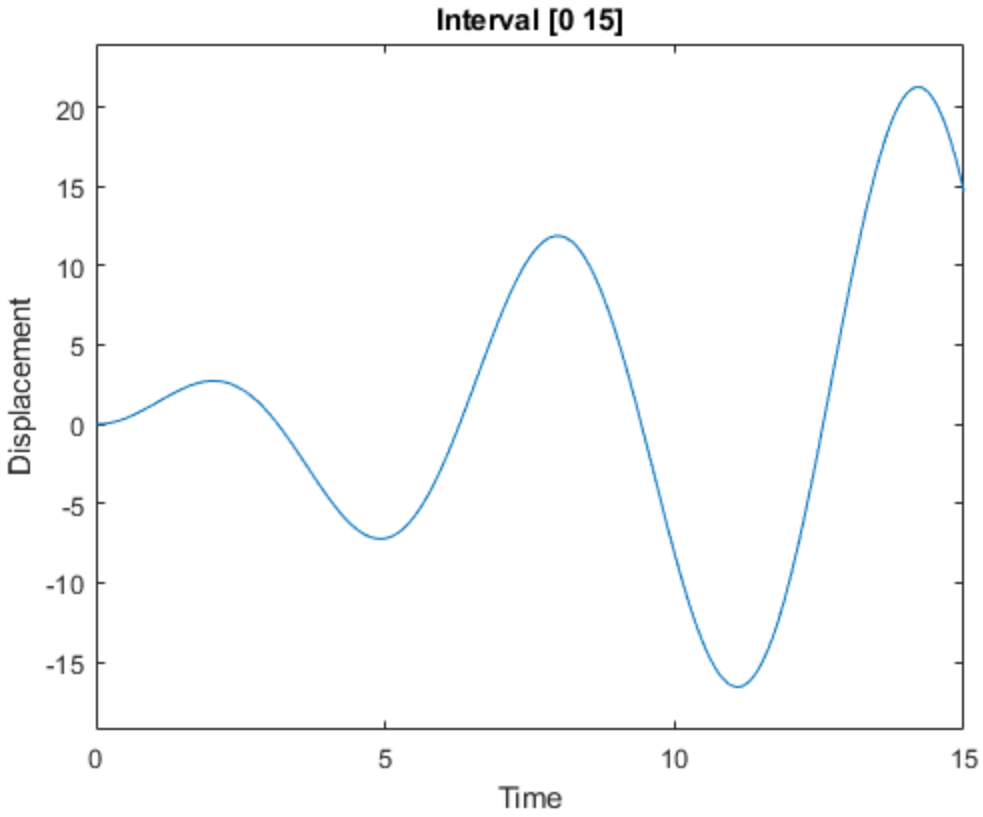

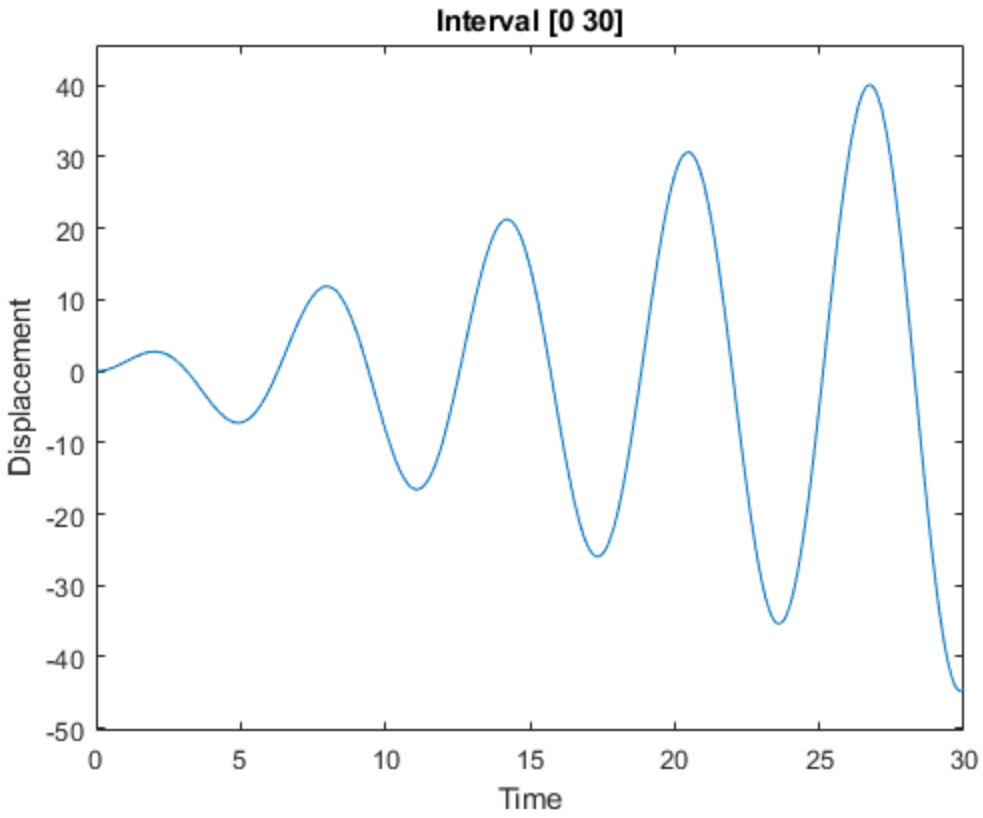

Problem 15 Part C

```
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.
```

```
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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            BusyAction: {'queue'  'cancel'}
          ButtonDownFcn: {}
```

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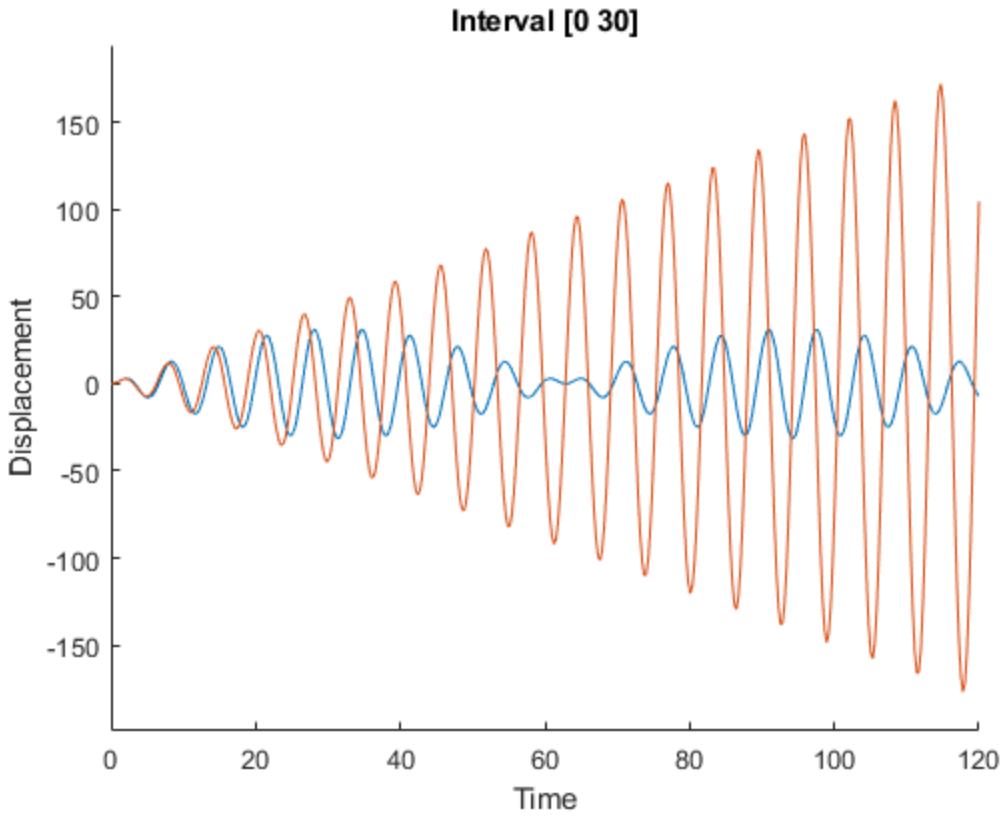

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