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```
syms q1 q2 q1d q2d
question4_func(q1, q2, q1d, q2d)
function []= question4_func(q1, q2, q1d, q2d)

clc
%clear all;
close all;

I1=1; I2 = 1; m1=0.5; r1=0.15; m2=0.5; r2=.15; l1=0.3; l2=0.3;

a = I1+I2+m1*r1^2+ m2*(l1^2+ r2^2);
b = m2*l1*r2;
d = I2+ m2*r2^2;

global Mmat_symb Cmat_symb G_matrix_symb
```

Model equations

```
Mmat_symb = [a+2*b*cos(q1), d+b*cos(q1); d+b*cos(q1), d];
Cmat_symb = [-b*sin(q1)*q2d, -b*sin(q1)*(q1d+q2d); b*sin(q2)*q1d,0];
g = 9.81;
G_matrix_symb = [(m1*r1 + m2*l1)*g * sin(q1) + m2 * r2 * g * sin(q1 +
q2);...
m2 * r2 * g * sin(q1 + q2)];

%xd = input('X coordinate ');
%yd = input('Y coordinate ');
```

position calculations

```
posi = [0.300,0.450]
posf = [-0.300,0.450]

[q1l,qi2] = twoDOFIK(posi(1),posi(2),1);
[qf1,qf2] = twoDOFIK(posf(1),posf(2),-1);
```

```
x0= [qi1,qi2,0,0]; % Initial Condition - Format:
[theta1,theta2,dtheta1,dtheta2]
```

```
tf=10;
```

```
posi =
```

```
0.3000    0.4500
```

```
posf =
```

```
-0.3000    0.4500
```

Solve the closed-loop system nonlinear differential equation (PlanarArmODE) via ode45

```
%ode45 solves the differential equation and returns X with respect to
T.
```

```
global torque
```

```
torque=[];
```

```
[T,X] = ode45(@(t,x)planarArmODE(t,x),[0 tf],x0);
```

```
temp = ones(length(X(:,1)));
```

```
[x,y] = twoDOFFK([X(:,1),X(:,2)],l1,l2);
```

```
poses = [x,y];
```

```
linkx = l1*cos(X(:,1));
```

```
linky = l1*sin(X(:,1)) ;
```

```
links = [linkx,linky];
```

```
error_joints = [temp * qf1 - X(:,1),temp * qf1 - X(:,2)];
```

```
error_task = sqrt((posf(1)-x).^2 + (posf(2)-y).^2) ;
```

```
task_velocity = diff(poses);
```

```
t =
```

```
0
```

```
time =
```

```
0
```

```
dx =
```

```
1.0e+03 *  
0  
0  
1.7640  
0
```

```
t =  
  
2.2783e-08
```

```
time =  
  
2.2783e-08
```

```
dx =  
  
1.0e+03 *  
0.0000  
0  
1.7640  
0
```

```
t =  
  
3.4175e-08
```

```
time =  
  
3.4175e-08
```

```
dx =  
  
1.0e+03 *  
0.0000  
0  
1.7640  
0
```

```
t =  
  
9.1134e-08
```

```
time =  
    9.1134e-08
```

```
dx =  
    1.0e+03 *  
    0.0000  
      0  
    1.7640  
      0
```

```
t =  
    1.0126e-07
```

```
time =  
    1.0126e-07
```

```
dx =  
    1.0e+03 *  
    0.0000  
      0  
    1.7640  
      0
```

```
t =  
    1.1392e-07
```

```
time =  
    1.1392e-07
```

```
dx =  
    1.0e+03 *  
    0.0000  
      0  
    1.7640  
      0
```

$t =$
 $1.1392e-07$

$time =$
 $1.1392e-07$

$dx =$
 $1.0e+03 *$
 0.0000
 0
 1.7640
 0

$t =$
 $2.2783e-07$

$time =$
 $2.2783e-07$

$dx =$
 $1.0e+03 *$
 0.0000
 0
 1.7640
 0

$t =$
 $2.8479e-07$

$time =$
 $2.8479e-07$

$dx =$
 $1.0e+03 *$

```

0.0000
  0
1.7640
  0

t =

5.6959e-07

time =

5.6959e-07

dx =

1.0e+03 *

0.0000
  0
1.7639
  0

t =

6.2022e-07

time =

6.2022e-07

dx =

1.0e+03 *

0.0000
  0
1.7639
  0

t =

6.8350e-07

time =
```

6.8350e-07

dx =

1.0e+03 *

0.0000

0

1.7639

0

t =

6.8350e-07

time =

6.8350e-07

dx =

1.0e+03 *

0.0000

0

1.7639

0

t =

1.2531e-06

time =

1.2531e-06

dx =

1.0e+03 *

0.0000

0

1.7638

0

t =

1.5379e-06

time =

1.5379e-06

dx =

1.0e+03 *

0.0000

0

1.7638

0

t =

2.9618e-06

time =

2.9618e-06

dx =

1.0e+03 *

0.0000

0

1.7636

0

t =

3.2150e-06

time =

3.2150e-06

dx =

1.0e+03 *

0.0000

```

      0
    1.7636
      0

t =

    3.5314e-06

time =

    3.5314e-06

dx =

    1.0e+03 *

    0.0000
      0
    1.7635
      0

t =

    3.5314e-06

time =

    3.5314e-06

dx =

    1.0e+03 *

    0.0000
      0
    1.7635
      0

t =

    6.3794e-06

time =

    6.3794e-06

```

$dx =$

$1.0e+03 *$

0.0000

0

1.7631

0

$t =$

$7.8033e-06$

$time =$

$7.8033e-06$

$dx =$

$1.0e+03 *$

0.0000

0

1.7629

0

$t =$

$1.4923e-05$

$time =$

$1.4923e-05$

$dx =$

$1.0e+03 *$

0.0000

0

1.7620

0

$t =$

$1.6189e-05$

$time =$
 $1.6189e-05$

$dx =$
 $1.0e+03 *$
 0.0000
 0
 1.7618
 0

$t =$
 $1.7771e-05$

$time =$
 $1.7771e-05$

$dx =$
 $1.0e+03 *$
 0.0000
 0
 1.7616
 0

$t =$
 $1.7771e-05$

$time =$
 $1.7771e-05$

$dx =$
 $1.0e+03 *$
 0.0000
 0
 1.7616

0

$t =$

3.2011e-05

time =

3.2011e-05

$dx =$

1.0e+03 *

0.0001

0

1.7596

0

$t =$

3.9131e-05

time =

3.9131e-05

$dx =$

1.0e+03 *

0.0001

0

1.7587

0

$t =$

7.4730e-05

time =

7.4730e-05

$dx =$

```

1.0e+03 *
0.0001
0
1.7538
0

t =

8.1058e-05

time =

8.1058e-05

dx =

1.0e+03 *
0.0001
0
1.7530
0

t =

8.8969e-05

time =

8.8969e-05

dx =

1.0e+03 *
0.0002
0
1.7519
0

t =

8.8969e-05
```

```
time =  
      8.8969e-05
```

```
dx =  
      1.0e+03 *  
      0.0002  
      0  
      1.7519  
      0
```

```
t =  
      1.6017e-04
```

```
time =  
      1.6017e-04
```

```
dx =  
      1.0e+03 *  
      0.0003  
      0  
      1.7422  
      0
```

```
t =  
      1.9577e-04
```

```
time =  
      1.9577e-04
```

```
dx =  
      1.0e+03 *  
      0.0003  
      0  
      1.7374  
      0
```

$t =$
 $3.7376e-04$

$time =$
 $3.7376e-04$

$dx =$
 $1.0e+03 *$
 0.0006
 0
 1.7135
 0

$t =$
 $4.0541e-04$

$time =$
 $4.0541e-04$

$dx =$
 $1.0e+03 *$
 0.0007
 0
 1.7093
 0

$t =$
 $4.4496e-04$

$time =$
 $4.4496e-04$

$dx =$
 $1.0e+03 *$

```

0.0008
  0
1.7040
  0

t =

4.4496e-04

time =

4.4496e-04

dx =

1.0e+03 *

0.0008
  0
1.7040
  0

t =

8.0095e-04

time =

8.0095e-04

dx =

1.0e+03 *

0.0014
  0
1.6566
  0

t =

9.7895e-04

time =
```

9.7895e-04

$\dot{dx} =$

1.0e+03 *

0.0017

0

1.6340

0

$t =$

0.0019

$time =$

0.0019

$\dot{dx} =$

1.0e+03 *

0.0031

0

1.5219

0

$t =$

0.0020

$time =$

0.0020

$\dot{dx} =$

1.0e+03 *

0.0033

0

1.5022

0

$t =$

```

0.0022

time =

0.0022

dx =

1.0e+03 *

0.0036
0
1.4784
0

t =

0.0022

time =

0.0022

dx =

1.0e+03 *

0.0036
0
1.4789
0

t =

0.0040

time =

0.0040

dx =

1.0e+03 *

0.0062
```

```

      0
    1.2654
      0

t =

    0.0049

time =

    0.0049

dx =

    1.0e+03 *
    0.0071
      0
    1.1838
      0

t =

    0.0093

time =

    0.0093

dx =

    11.8877
      0
    762.6160
      0

t =

    0.0101

time =

    0.0101

dx =
```

```
13.3941
  0
655.5317
  0
```

```
t =

0.0111
```

```
time =

0.0111
```

```
dx =

14.0461
  0
586.0988
  0
```

```
t =

0.0111
```

```
time =

0.0111
```

```
dx =

12.7545
  0
652.5364
  0
```

```
t =

0.0135
```

```
time =

0.0135
```

```
dx =
```

```
14.3168
  0
485.7160
  0
```

```
t =

0.0147
```

```
time =

0.0147
```

```
dx =

14.6486
  0
430.7985
  0
```

```
t =

0.0207
```

```
time =

0.0207
```

```
dx =

17.0212
  0
122.6175
  0
```

```
t =

0.0218
```

```
time =

0.0218
```

```
dx =
```

```
18.6256
  0
 7.6718
  0
```

```
t =

0.0231
```

```
time =

0.0231
```

```
dx =

18.7530
  0
-34.7593
  0
```

```
t =

0.0231
```

```
time =

0.0231
```

```
dx =

16.6548
  0
76.1196
  0
```

```
t =

0.0258
```

```
time =

0.0258
```

```
dx =
```

```
16.8614
  0
-7.7063
  0
```

```
t =
```

```
0.0272
```

```
time =
```

```
0.0272
```

```
dx =
```

```
16.7087
  0
-30.7354
  0
```

```
t =
```

```
0.0340
```

```
time =
```

```
0.0340
```

```
dx =
```

```
16.5722
  0
-176.9602
  0
```

```
t =
```

```
0.0352
```

```
time =
```

```
0.0352
```

```
dx =
```

```
17.5189
0
-254.7267
0
```

```
t =
```

```
0.0367
```

```
time =
```

```
0.0367
```

```
dx =
```

```
17.2822
0
-270.8201
0
```

```
t =
```

```
0.0367
```

```
time =
```

```
0.0367
```

```
dx =
```

```
15.6310
0
-179.0750
0
```

```
t =
```

```
0.0397
```

```
time =
```

```
0.0397
```

```
dx =
```

```
15.0896
0
-208.0237
0
```

```
t =
```

```
0.0412
```

```
time =
```

```
0.0412
```

```
dx =
```

```
14.7204
0
-212.1094
0
```

```
t =
```

```
0.0488
```

```
time =
```

```
0.0488
```

```
dx =
```

```
13.3236
0
-256.3074
0
```

```
t =
```

```
0.0501
```

```
time =
```

```
0.0501
```

```
dx =
```

```
13.7335
0
-301.8942
0
```

```
t =
```

```
0.0518
```

```
time =
```

```
0.0518
```

```
dx =
```

```
13.3668
0
-303.4947
0
```

```
t =
```

```
0.0518
```

```
time =
```

```
0.0518
```

```
dx =
```

```
12.2919
0
-238.6614
0
```

```
t =
```

```
0.0552
```

```
time =
```

```
0.0552
```

```
dx =
```

```
11.4840
0
-238.4959
0
```

```
t =
```

```
0.0569
```

```
time =
```

```
0.0569
```

```
dx =
```

```
11.0807
0
-233.8472
0
```

```
t =
```

```
0.0653
```

```
time =
```

```
0.0653
```

```
dx =
```

```
9.3396
0
-226.8709
0
```

```
t =
```

```
0.0668
```

```
time =
```

```
0.0668
```

```
dx =
```

```
      9.4112
      0
    -250.4924
      0
```

```
t =
```

```
      0.0687
```

```
time =
```

```
      0.0687
```

```
dx =
```

```
      9.0584
      0
    -246.1696
      0
```

```
t =
```

```
      0.0687
```

```
time =
```

```
      0.0687
```

```
dx =
```

```
      8.4670
      0
    -204.6618
      0
```

```
t =
```

```
      0.0724
```

```
time =
```

```
      0.0724
```

```
dx =
```

```
      7.7045
      0
    -192.9158
      0
```

```
t =
```

```
    0.0743
```

```
time =
```

```
    0.0743
```

```
dx =
```

```
      7.3724
      0
    -186.0623
      0
```

```
t =
```

```
    0.0836
```

```
time =
```

```
    0.0836
```

```
dx =
```

```
      5.8319
      0
    -160.6275
      0
```

```
t =
```

```
    0.0853
```

```
time =
```

```
    0.0853
```

```
dx =
```

```
      5.7056
      0
    -169.1261
      0
```

```
t =
```

```
      0.0873
```

```
time =
```

```
      0.0873
```

```
dx =
```

```
      5.4337
      0
    -163.7174
      0
```

```
t =
```

```
      0.0873
```

```
time =
```

```
      0.0873
```

```
dx =
```

```
      5.2306
      0
    -142.6618
      0
```

```
t =
```

```
      0.0914
```

```
time =
```

```
      0.0914
```

```
dx =
```

```
      4.6459
      0
    -129.5274
      0
```

```
t =
```

```
      0.0935
```

```
time =
```

```
      0.0935
```

```
dx =
```

```
      4.4141
      0
    -123.6073
      0
```

```
t =
```

```
      0.1037
```

```
time =
```

```
      0.1037
```

```
dx =
```

```
      3.2753
      0
    -97.6923
      0
```

```
t =
```

```
      0.1056
```

```
time =
```

```
      0.1056
```

```
dx =
```

```
      3.0784
      0
    -98.2283
      0
```

```
t =
```

```
    0.1078
```

```
time =
```

```
    0.1078
```

```
dx =
```

```
      2.8968
      0
    -93.8470
      0
```

```
t =
```

```
    0.1078
```

```
time =
```

```
    0.1078
```

```
dx =
```

```
      2.9199
      0
    -85.9879
      0
```

```
t =
```

```
    0.1124
```

```
time =
```

```
    0.1124
```

```
dx =
```

```
      2.5284
      0
    -75.6035
      0
```

```
t =
```

```
    0.1147
```

```
time =
```

```
    0.1147
```

```
dx =
```

```
      2.3859
      0
    -71.5234
      0
```

```
t =
```

```
    0.1260
```

```
time =
```

```
    0.1260
```

```
dx =
```

```
      1.6421
      0
    -51.8441
      0
```

```
t =
```

```
    0.1281
```

```
time =
```

```
    0.1281
```

```
dx =
```

```
      1.4471
      0
    -49.1064
      0
```

```
t =
```

```
      0.1306
```

```
time =
```

```
      0.1306
```

```
dx =
```

```
      1.3388
      0
    -46.2201
      0
```

```
t =
```

```
      0.1306
```

```
time =
```

```
      0.1306
```

```
dx =
```

```
      1.4642
      0
    -45.4821
      0
```

```
t =
```

```
      0.1358
```

```
time =
```

```
      0.1358
```

```
dx =
```

```
      1.2264
      0
    -38.5438
      0
```

```
t =
```

```
      0.1384
```

```
time =
```

```
      0.1384
```

```
dx =
```

```
      1.1483
      0
    -36.1374
      0
```

```
t =
```

```
      0.1515
```

```
time =
```

```
      0.1515
```

```
dx =
```

```
      0.7043
      0
    -23.3255
      0
```

```
t =
```

```
      0.1538
```

```
time =
```

```
      0.1538
```

```
dx =
```

```
      0.5350
      0
    -19.6700
      0
```

```
t =
```

```
      0.1567
```

```
time =
```

```
      0.1567
```

```
dx =
```

```
      0.4762
      0
    -18.0330
      0
```

```
t =
```

```
      0.1567
```

```
time =
```

```
      0.1567
```

```
dx =
```

```
      0.6383
      0
    -20.6373
      0
```

```
t =
```

```
      0.1638
```

```
time =
```

```
      0.1638
```

```
dx =
```

```
    0.4932
      0
  -16.1306
      0
```

```
t =
```

```
    0.1673
```

```
time =
```

```
    0.1673
```

```
dx =
```

```
    0.4563
      0
  -14.9171
      0
```

```
t =
```

```
    0.1849
```

```
time =
```

```
    0.1849
```

```
dx =
```

```
    0.1815
      0
   -6.6201
      0
```

```
t =
```

```
    0.1880
```

```
time =
```

```
    0.1880
```

```
dx =
```

```
-0.0116
      0
-1.6665
      0
```

```
t =

      0.1919
```

```
time =

      0.1919
```

```
dx =

-0.0456
      0
-0.8149
      0
```

```
t =

      0.1919
```

```
time =

      0.1919
```

```
dx =

      0.2003
      0
-6.6977
      0
```

```
t =

      0.1981
```

```
time =

      0.1981
```

```
dx =
```

```
    0.1589
      0
  -5.3466
      0
```

```
t =
```

```
    0.2012
```

```
time =
```

```
    0.2012
```

```
dx =
```

```
    0.1475
      0
  -4.9668
      0
```

```
t =
```

```
    0.2166
```

```
time =
```

```
    0.2166
```

```
dx =
```

```
    0.0689
      0
  -2.4281
      0
```

```
t =
```

```
    0.2194
```

```
time =
```

```
    0.2194
```

```
dx =
```

```
    0.0190
      0
    -0.9413
      0
```

```
t =
```

```
    0.2228
```

```
time =
```

```
    0.2228
```

```
dx =
```

```
    0.0084
      0
    -0.6155
      0
```

```
t =
```

```
    0.2228
```

```
time =
```

```
    0.2228
```

```
dx =
```

```
    0.0704
      0
    -2.4039
      0
```

```
t =
```

```
    0.2280
```

```
time =
```

```
    0.2280
```

```
dx =
```

```
0.0580
0
-1.9877
0
```

```
t =
```

```
0.2306
```

```
time =
```

```
0.2306
```

```
dx =
```

```
0.0542
0
-1.8587
0
```

```
t =
```

```
0.2435
```

```
time =
```

```
0.2435
```

```
dx =
```

```
0.0307
0
-1.0719
0
```

```
t =
```

```
0.2458
```

```
time =
```

```
0.2458
```

```
dx =
```

```
    0.0189
      0
    -0.6956
      0
```

```
t =
```

```
    0.2486
```

```
time =
```

```
    0.2486
```

```
dx =
```

```
    0.0156
      0
    -0.5867
      0
```

```
t =
```

```
    0.2486
```

```
time =
```

```
    0.2486
```

```
dx =
```

```
    0.0290
      0
    -1.0034
      0
```

```
t =
```

```
    0.2535
```

```
time =
```

```
    0.2535
```

```
dx =
```

```
    0.0241
      0
    -0.8361
      0
```

```
t =
```

```
    0.2560
```

```
time =
```

```
    0.2560
```

```
dx =
```

```
    0.0225
      0
    -0.7832
      0
```

```
t =
```

```
    0.2682
```

```
time =
```

```
    0.2682
```

```
dx =
```

```
    0.0132
      0
    -0.4657
      0
```

```
t =
```

```
    0.2703
```

```
time =
```

```
    0.2703
```

```
dx =
```

```
    0.0088
      0
    -0.3197
      0
```

```
t =
```

```
    0.2730
```

```
time =
```

```
    0.2730
```

```
dx =
```

```
    0.0075
      0
    -0.2748
      0
```

```
t =
```

```
    0.2730
```

```
time =
```

```
    0.2730
```

```
dx =
```

```
    0.0124
      0
    -0.4334
      0
```

```
t =
```

```
    0.2778
```

```
time =
```

```
    0.2778
```

```
dx =
```

```
    0.0103
      0
  -0.3624
      0
```

```
t =
```

```
    0.2802
```

```
time =
```

```
    0.2802
```

```
dx =
```

```
    0.0097
      0
  -0.3397
      0
```

```
t =
```

```
    0.2920
```

```
time =
```

```
    0.2920
```

```
dx =
```

```
    0.0058
      0
  -0.2046
      0
```

```
t =
```

```
    0.2941
```

```
time =
```

```
    0.2941
```

```
dx =
```

```
0.0040
0
-0.1432
0
```

```
t =
```

```
0.2967
```

```
time =
```

```
0.2967
```

```
dx =
```

```
0.0034
0
-0.1239
0
```

```
t =
```

```
0.2967
```

```
time =
```

```
0.2967
```

```
dx =
```

```
0.0054
0
-0.1901
0
```

```
t =
```

```
0.3014
```

```
time =
```

```
0.3014
```

```
dx =
```

```
    0.0045
      0
    -0.1592
      0
```

```
t =
```

```
    0.3037
```

```
time =
```

```
    0.3037
```

```
dx =
```

```
    0.0042
      0
    -0.1494
      0
```

```
t =
```

```
    0.3153
```

```
time =
```

```
    0.3153
```

```
dx =
```

```
    0.0025
      0
    -0.0906
      0
```

```
t =
```

```
    0.3174
```

```
time =
```

```
    0.3174
```

```
dx =
```

```
    0.0018
      0
    -0.0641
      0
```

```
t =
```

```
    0.3199
```

```
time =
```

```
    0.3199
```

```
dx =
```

```
    0.0015
      0
    -0.0557
      0
```

```
t =
```

```
    0.3199
```

```
time =
```

```
    0.3199
```

```
dx =
```

```
    0.0024
      0
    -0.0841
      0
```

```
t =
```

```
    0.3245
```

```
time =
```

```
    0.3245
```

```
dx =
```

```
0.0020
0
-0.0705
0
```

```
t =
```

```
0.3268
```

```
time =
```

```
0.3268
```

```
dx =
```

```
0.0019
0
-0.0662
0
```

```
t =
```

```
0.3382
```

```
time =
```

```
0.3382
```

```
dx =
```

```
0.0011
0
-0.0403
0
```

```
t =
```

```
0.3403
```

```
time =
```

```
0.3403
```

```
dx =
```

```
    0.0008
      0
    -0.0287
      0
```

```
t =
```

```
    0.3428
```

```
time =
```

```
    0.3428
```

```
dx =
```

```
    0.0007
      0
    -0.0250
      0
```

```
t =
```

```
    0.3428
```

```
time =
```

```
    0.3428
```

```
dx =
```

```
    0.0010
      0
    -0.0374
      0
```

```
t =
```

```
    0.3473
```

```
time =
```

```
    0.3473
```

```
dx =
```

```
    0.0009
      0
  -0.0314
      0
```

```
t =
```

```
    0.3496
```

```
time =
```

```
    0.3496
```

```
dx =
```

```
    0.0008
      0
  -0.0295
      0
```

```
t =
```

```
    0.3609
```

```
time =
```

```
    0.3609
```

```
dx =
```

```
    0.0005
      0
  -0.0180
      0
```

```
t =
```

```
    0.3629
```

```
time =
```

```
    0.3629
```

```
dx =
```

```
0.0004
0
-0.0129
0
```

```
t =
```

```
0.3654
```

```
time =
```

```
0.3654
```

```
dx =
```

```
0.0003
0
-0.0112
0
```

```
t =
```

```
0.3654
```

```
time =
```

```
0.3654
```

```
dx =
```

```
0.0005
0
-0.0167
0
```

```
t =
```

```
0.3699
```

```
time =
```

```
0.3699
```

```
dx =
```

```
    0.0004
      0
  -0.0141
      0
```

```
t =
```

```
    0.3721
```

```
time =
```

```
    0.3721
```

```
dx =
```

```
    0.0004
      0
  -0.0132
      0
```

```
t =
```

```
    0.3833
```

```
time =
```

```
    0.3833
```

```
dx =
```

```
    0.0002
      0
  -0.0081
      0
```

```
t =
```

```
    0.3853
```

```
time =
```

```
    0.3853
```

```
dx =
```

```
    0.0002
      0
  -0.0058
      0
```

```
t =
```

```
    0.3878
```

```
time =
```

```
    0.3878
```

```
dx =
```

```
    0.0001
      0
  -0.0051
      0
```

```
t =
```

```
    0.3878
```

```
time =
```

```
    0.3878
```

```
dx =
```

```
    0.0002
      0
  -0.0075
      0
```

```
t =
```

```
    0.3930
```

```
time =
```

```
    0.3930
```

```
dx =
```

```
    0.0002
      0
  -0.0061
      0
```

```
t =
```

```
    0.3956
```

```
time =
```

```
    0.3956
```

```
dx =
```

```
    0.0002
      0
  -0.0057
      0
```

```
t =
```

```
    0.4085
```

```
time =
```

```
    0.4085
```

```
dx =
```

```
    0.0001
      0
  -0.0030
      0
```

```
t =
```

```
    0.4108
```

```
time =
```

```
    0.4108
```

```
dx =
```

```
0.0000
0
-0.0015
0
```

```
t =
```

```
0.4137
```

```
time =
```

```
0.4137
```

```
dx =
```

```
0.0000
0
-0.0012
0
```

```
t =
```

```
0.4137
```

```
time =
```

```
0.4137
```

```
dx =
```

```
0.0001
0
-0.0030
0
```

```
t =
```

```
0.4197
```

```
time =
```

```
0.4197
```

```
dx =
```

```

    0.0001
      0
    -0.0023
      0

t =

    0.4227

time =

    0.4227

dx =

    0.0001
      0
    -0.0022
      0

t =

    0.4376

time =

    0.4376

dx =

    1.0e-03 *
    0.0248
      0
    -0.9106
      0

t =

    0.4403

time =

    0.4403
```

```
dx =  
  
1.0e-05 *  
  
-0.0444  
0  
-0.8274  
0
```

```
t =  
  
0.4436
```

```
time =  
  
0.4436
```

```
dx =  
  
1.0e-03 *  
  
-0.0056  
0  
0.1762  
0
```

```
t =  
  
0.4436
```

```
time =  
  
0.4436
```

```
dx =  
  
0.0000  
0  
-0.0010  
0
```

```
t =  
  
0.4507
```

```
time =  
  
    0.4507  
  
dx =  
  
1.0e-03 *  
  
    0.0204  
    0  
   -0.7432  
    0
```

```
t =  
  
    0.4543
```

```
time =  
  
    0.4543
```

```
dx =  
  
1.0e-03 *  
  
    0.0189  
    0  
   -0.6886  
    0
```

```
t =  
  
    0.4720
```

```
time =  
  
    0.4720
```

```
dx =  
  
1.0e-03 *  
  
    0.0043  
    0  
   -0.1605  
    0
```

```
t =  
  
    0.4752  
  
time =  
  
    0.4752  
  
dx =  
  
    1.0e-03 *  
  
    -0.0100  
        0  
    0.3542  
        0
```

```
t =  
  
    0.4791
```

```
time =  
  
    0.4791
```

```
dx =  
  
    1.0e-03 *  
  
    -0.0126  
        0  
    0.4480  
        0
```

```
t =  
  
    0.4791
```

```
time =  
  
    0.4791
```

```
dx =  
  
    1.0e-03 *
```

```

    0.0076
      0
    -0.2770
      0

t =

    0.4878

time =

    0.4878

dx =

    1.0e-03 *
      0.0052
      0
    -0.1896
      0

t =

    0.4921

time =

    0.4921

dx =

    1.0e-03 *
      0.0048
      0
    -0.1768
      0

t =

    0.5137

time =
```

0.5137

$\vec{dx} =$

1.0e-04 *

-0.0072

0

0.2478

0

$t =$

0.5176

time =

0.5176

$\vec{dx} =$

1.0e-03 *

-0.0081

0

0.2931

0

$t =$

0.5224

time =

0.5224

$\vec{dx} =$

1.0e-03 *

-0.0096

0

0.3452

0

$t =$

```

0.5224

time =

0.5224

dx =

1.0e-04 *

0.0161
0
-0.5906
0

t =

0.5333

time =

0.5333

dx =

1.0e-04 *

0.0096
0
-0.3544
0

t =

0.5388

time =

0.5388

dx =

1.0e-04 *

0.0093
```

```

      0
    -0.3422
      0

t =

    0.5661

time =

    0.5661

dx =

    1.0e-04 *
    -0.0097
      0
    0.3490
      0

t =

    0.5709

time =

    0.5709

dx =

    1.0e-03 *
    -0.0044
      0
    0.1591
      0

t =

    0.5770

time =

    0.5770
```

```
dx =  
  
1.0e-03 *  
  
-0.0052  
0  
0.1901  
0
```

```
t =  
  
0.5770
```

```
time =  
  
0.5770
```

```
dx =  
  
1.0e-04 *  
  
0.0027  
0  
-0.1004  
0
```

```
t =  
  
0.5914
```

```
time =  
  
0.5914
```

```
dx =  
  
1.0e-05 *  
  
0.0129  
0  
-0.4740  
0
```

```
t =  
  
0.5986
```

$time =$

0.5986

$dx =$

$1.0e-05 *$

0.0142

0

-0.5225

0

$t =$

0.6347

$time =$

0.6347

$dx =$

$1.0e-04 *$

-0.0050

0

0.1805

0

$t =$

0.6411

$time =$

0.6411

$dx =$

$1.0e-04 *$

-0.0198

0

0.7178

```

0

t =
    0.6492

time =
    0.6492

dx =
    1.0e-04 *
    -0.0252
         0
    0.9119
         0

t =
    0.6492

time =
    0.6492

dx =
    1.0e-05 *
    0.0078
         0
   -0.2810
         0

t =
    0.6690

time =
    0.6690

dx =

```

```

1.0e-06 *
0.0223
0
-0.8149
0

```

```

t =
0.6790

```

```

time =
0.6790

```

```

dx =
1.0e-05 *
0.0039
0
-0.1400
0

```

```

t =
0.7286

```

```

time =
0.7286

```

```

dx =
1.0e-04 *
-0.0039
0
0.1358
0

```

```

t =
0.7375

```

```
time =  
  
    0.7375  
  
dx =  
  
    1.0e-04 *  
  
    -0.0157  
      0  
    0.5483  
      0
```

```
t =  
  
    0.7485
```

```
time =  
  
    0.7485
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0220  
      0  
    0.7663  
      0
```

```
t =  
  
    0.7485
```

```
time =  
  
    0.7485
```

```
dx =  
  
    1.0e-05 *  
  
    0.0110  
      0  
    -0.3680  
      0
```

```
t =  
  
    0.7737  
  
time =  
  
    0.7737  
  
dx =  
  
1.0e-06 *  
  
    0.0170  
      0  
   -0.6441  
      0
```

```
t =  
  
    0.7862
```

```
time =  
  
    0.7862
```

```
dx =  
  
1.0e-05 *  
  
    0.0057  
      0  
   -0.1853  
      0
```

```
t =  
  
    0.8491
```

```
time =  
  
    0.8491
```

```
dx =  
  
1.0e-04 *
```

```
-0.0087
      0
    0.2590
      0

t =

    0.8602

time =

    0.8602

dx =

    1.0e-03 *
    -0.0036
      0
    0.1037
      0

t =

    0.8742

time =

    0.8742

dx =

    1.0e-03 *
    -0.0051
      0
    0.1404
      0

t =

    0.8742

time =
```

0.8742

$dx =$

$1.0e-05 *$

0.0193

0

-0.1013

0

$t =$

0.9019

$time =$

0.9019

$dx =$

$1.0e-05 *$

0.0165

0

-0.6882

0

$t =$

0.9158

$time =$

0.9158

$dx =$

$1.0e-05 *$

-0.0032

0

0.5673

0

$t =$

```

0.9851

time =

0.9851

dx =

1.0e-03 *

0.0064
0
-0.3703
0

t =

0.9974

time =

0.9974

dx =

0.0000
0
-0.0018
0

t =

1.0128

time =

1.0128

dx =

0.0001
0
-0.0038
0
```

```
t =  
  
    1.0128  
  
time =  
  
    1.0128  
  
dx =  
  
    1.0e-03 *  
  
    -0.0189  
        0  
    0.8722  
        0  
  
t =  
  
    0.8873  
  
time =  
  
    0.8873  
  
dx =  
  
    1.0e-05 *  
  
    0.0180  
        0  
    -0.3789  
        0  
  
t =  
  
    0.8939  
  
time =  
  
    0.8939  
  
dx =  
  
    1.0e-05 *
```

```

    0.0133
      0
    -0.1712
      0

t =

    0.9266

time =

    0.9266

dx =

    1.0e-04 *
      0.0066
      0
    -0.3572
      0

t =

    0.9325

time =

    0.9325

dx =

    1.0e-03 *
      0.0025
      0
    -0.1363
      0

t =

    0.9397

time =
```

0.9397

$dx =$

$1.0e-03 *$

0.0035

0

-0.1863

0

$t =$

0.9397

$time =$

0.9397

$dx =$

$1.0e-05 *$

-0.0107

0

0.5779

0

$t =$

0.9529

$time =$

0.9529

$dx =$

$1.0e-05 *$

-0.0031

0

0.2006

0

$t =$

```

0.9594

time =

0.9594

dx =

1.0e-05 *

-0.0049
0
0.2754
0

t =

0.9922

time =

0.9922

dx =

1.0e-04 *

0.0041
0
-0.1869
0

t =

0.9980

time =

0.9980

dx =

1.0e-04 *

0.0162
```

```

      0
    -0.7311
      0

t =

    1.0053

time =

    1.0053

dx =

    1.0e-04 *

    0.0213
      0
   -0.9593
      0

t =

    1.0053

time =

    1.0053

dx =

    1.0e-05 *

   -0.0067
      0
    0.3013
      0

t =

    1.0231

time =

    1.0231
```

```
dx =  
  
1.0e-06 *  
  
-0.0132  
0  
0.6405  
0
```

```
t =  
  
1.0321
```

```
time =  
  
1.0321
```

```
dx =  
  
1.0e-05 *  
  
-0.0034  
0  
0.1524  
0
```

```
t =  
  
1.0766
```

```
time =  
  
1.0766
```

```
dx =  
  
1.0e-04 *  
  
0.0047  
0  
-0.1996  
0
```

```
t =  
  
1.0846
```

$time =$

1.0846

$dx =$

$1.0e-04 *$

0.0192

0

-0.8199

0

$t =$

1.0945

$time =$

1.0945

$dx =$

$1.0e-03 *$

0.0028

0

-0.1192

0

$t =$

1.0945

$time =$

1.0945

$dx =$

$1.0e-05 *$

-0.0176

0

0.7349

```

0

t =

1.1152

time =

1.1152

dx =

1.0e-05 *
-0.0023
0
0.1019
0

t =

1.1255

time =

1.1255

dx =

1.0e-05 *
-0.0095
0
0.3958
0

t =

1.1772

time =

1.1772

dx =

```

```
1.0e-04 *  
  
0.0163  
0  
-0.6717  
0
```

```
t =  
  
1.1864
```

```
time =  
  
1.1864
```

```
dx =  
  
1.0e-03 *  
  
0.0069  
0  
-0.2836  
0
```

```
t =  
  
1.1979
```

```
time =  
  
1.1979
```

```
dx =  
  
1.0e-03 *  
  
0.0106  
0  
-0.4354  
0
```

```
t =  
  
1.1979
```

```
time =  
    1.1979  
  
dx =  
    1.0e-04 *  
    -0.0088  
        0  
    0.3610  
        0  
  
t =  
    1.2155  
  
time =  
    1.2155  
  
dx =  
    1.0e-04 *  
    -0.0025  
        0  
    0.1032  
        0  
  
t =  
    1.2242  
  
time =  
    1.2242  
  
dx =  
    1.0e-04 *  
    -0.0044  
        0  
    0.1809  
        0
```

```
t =  
  
    1.2681  
  
time =  
  
    1.2681  
  
dx =  
  
    1.0e-03 *  
  
    0.0045  
        0  
    -0.1813  
        0
```

```
t =  
  
    1.2759
```

```
time =  
  
    1.2759
```

```
dx =  
  
    1.0e-03 *  
  
    0.0182  
        0  
    -0.7363  
        0
```

```
t =  
  
    1.2857
```

```
time =  
  
    1.2857
```

```
dx =  
  
    0.0000
```

```

      0
    -0.0010
      0

t =

    1.2857

time =

    1.2857

dx =

    1.0e-04 *
    -0.0139
      0
    0.5601
      0

t =

    1.2113

time =

    1.2113

dx =

    1.0e-04 *
    -0.0040
      0
    0.1641
      0

t =

    1.2180

time =

    1.2180

```

```
dx =  
  
1.0e-04 *  
  
-0.0046  
0  
0.1862  
0
```

```
t =  
  
1.2515
```

```
time =  
  
1.2515
```

```
dx =  
  
1.0e-04 *  
  
0.0181  
0  
-0.7331  
0
```

```
t =  
  
1.2575
```

```
time =  
  
1.2575
```

```
dx =  
  
1.0e-03 *  
  
0.0072  
0  
-0.2911  
0
```

```
t =  
  
1.2649
```

$time =$

1.2649

$dx =$

$1.0e-03 *$

0.0093

0

-0.3743

0

$t =$

1.2649

$time =$

1.2649

$dx =$

$1.0e-04 *$

-0.0030

0

0.1206

0

$t =$

1.2783

$time =$

1.2783

$dx =$

$1.0e-05 *$

-0.0137

0

0.5533

```

0

t =
    1.2850

time =
    1.2850

dx =
    1.0e-05 *
    -0.0154
         0
    0.6235
         0

t =
    1.3185

time =
    1.3185

dx =
    1.0e-04 *
    0.0059
         0
   -0.2385
         0

t =
    1.3245

time =
    1.3245

dx =

```

```

1.0e-04 *
0.0236
0
-0.9476
0

```

```

t =
1.3319

```

```

time =
1.3319

```

```

dx =
1.0e-03 *
0.0030
0
-0.1216
0

```

```

t =
1.3319

```

```

time =
1.3319

```

```

dx =
1.0e-05 *
-0.0097
0
0.3911
0

```

```

t =
1.3495

```

```
time =  
  
    1.3495  
  
dx =  
  
    1.0e-05 *  
  
    -0.0029  
        0  
    0.1156  
        0
```

```
t =  
  
    1.3583
```

```
time =  
  
    1.3583
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0049  
        0  
    0.1959  
        0
```

```
t =  
  
    1.4022
```

```
time =  
  
    1.4022
```

```
dx =  
  
    1.0e-04 *  
  
    0.0047  
        0  
    -0.1885  
        0
```

```
t =  
  
    1.4100  
  
time =  
  
    1.4100  
  
dx =  
  
    1.0e-04 *  
  
    0.0191  
      0  
   -0.7646  
      0  
  
t =  
  
    1.4197  
  
time =  
  
    1.4197  
  
dx =  
  
    1.0e-03 *  
  
    0.0027  
      0  
   -0.1078  
      0  
  
t =  
  
    1.4197  
  
time =  
  
    1.4197  
  
dx =  
  
    1.0e-05 *
```

```
-0.0142
      0
    0.5666
      0

t =

    1.4409

time =

    1.4409

dx =

    1.0e-06 *
    -0.0221
      0
    0.8875
      0

t =

    1.4514

time =

    1.4514

dx =

    1.0e-05 *
    -0.0076
      0
    0.3028
      0

t =

    1.5043

time =
```

1.5043

$\dot{dx} =$

1.0e-04 *

0.0123

0

-0.4905

0

$t =$

1.5137

$time =$

1.5137

$\dot{dx} =$

1.0e-03 *

0.0052

0

-0.2067

0

$t =$

1.5255

$time =$

1.5255

$\dot{dx} =$

1.0e-03 *

0.0079

0

-0.3159

0

$t =$

```

1.5255

time =

1.5255

dx =

1.0e-04 *

-0.0065
0
0.2578
0

t =

1.5445

time =

1.5445

dx =

1.0e-05 *

-0.0157
0
0.6259
0

t =

1.5541

time =

1.5541

dx =

1.0e-04 *

-0.0033
```

```

      0
    0.1312
      0

t =

    1.6018

time =

    1.6018

dx =

    1.0e-03 *

    0.0040
      0
   -0.1577
      0

t =

    1.6102

time =

    1.6102

dx =

    1.0e-03 *

    0.0164
      0
   -0.6484
      0

t =

    1.6208

time =

    1.6208

```

```
dx =  
  
1.0e-03 *  
  
0.0238  
0  
-0.9435  
0
```

```
t =  
  
1.6208
```

```
time =  
  
1.6208
```

```
dx =  
  
1.0e-04 *  
  
-0.0150  
0  
0.5937  
0
```

```
t =  
  
1.5399
```

```
time =  
  
1.5399
```

```
dx =  
  
1.0e-04 *  
  
-0.0028  
0  
0.1102  
0
```

```
t =  
  
1.5471
```

$time =$

1.5471

$dx =$

$1.0e-04 *$

-0.0033

0

0.1314

0

$t =$

1.5832

$time =$

1.5832

$dx =$

$1.0e-04 *$

0.0157

0

-0.6234

0

$t =$

1.5896

$time =$

1.5896

$dx =$

$1.0e-03 *$

0.0062

0

-0.2476

```

0

t =
    1.5976

time =
    1.5976

dx =
    1.0e-03 *
    0.0082
    0
   -0.3238
    0

t =
    1.5976

time =
    1.5976

dx =
    1.0e-04 *
   -0.0028
    0
    0.1121
    0

t =
    1.6120

time =
    1.6120

dx =

```

```

1.0e-05 *
-0.0121
  0
0.4809
  0

```

```

t =

1.6192

```

```

time =

1.6192

```

```

dx =

1.0e-05 *
-0.0144
  0
0.5720
  0

```

```

t =

1.6553

```

```

time =

1.6553

```

```

dx =

1.0e-04 *
0.0068
  0
-0.2688
  0

```

```

t =

1.6617

```

$time =$

1.6617

$dx =$

$1.0e-03 *$

0.0027

0

-0.1067

0

$t =$

1.6697

$time =$

1.6697

$dx =$

$1.0e-03 *$

0.0035

0

-0.1395

0

$t =$

1.6697

$time =$

1.6697

$dx =$

$1.0e-05 *$

-0.0122

0

0.4818

0

```
t =  
  
    1.6876  
  
time =  
  
    1.6876  
  
dx =  
  
    1.0e-05 *  
  
    -0.0036  
         0  
    0.1410  
         0  
  
t =  
  
    1.6966  
  
time =  
  
    1.6966  
  
dx =  
  
    1.0e-05 *  
  
    -0.0061  
         0  
    0.2417  
         0  
  
t =  
  
    1.7413  
  
time =  
  
    1.7413  
  
dx =  
  
    1.0e-04 *
```

```

    0.0060
      0
    -0.2361
      0

t =

    1.7493

time =

    1.7493

dx =

    1.0e-04 *
    0.0243
      0
    -0.9585
      0

t =

    1.7592

time =

    1.7592

dx =

    1.0e-03 *
    0.0034
      0
    -0.1355
      0

t =

    1.7592

time =
```

1.7592

$\dot{dx} =$

1.0e-05 *

-0.0184

0

0.7254

0

$t =$

1.7797

$time =$

1.7797

$\dot{dx} =$

1.0e-05 *

-0.0035

0

0.1393

0

$t =$

1.7900

$time =$

1.7900

$\dot{dx} =$

1.0e-05 *

-0.0096

0

0.3788

0

$t =$

```

1.8412

time =

1.8412

dx =

1.0e-04 *

0.0139
0
-0.5477
0

t =

1.8503

time =

1.8503

dx =

1.0e-03 *

0.0058
0
-0.2285
0

t =

1.8617

time =

1.8617

dx =

1.0e-03 *

0.0087
```

```

      0
    -0.3426
      0

t =

    1.8617

time =

    1.8617

dx =

    1.0e-04 *
    -0.0064
         0
    0.2532
         0

t =

    1.8802

time =

    1.8802

dx =

    1.0e-05 *
    -0.0176
         0
    0.6928
         0

t =

    1.8894

time =

    1.8894
```

```
dx =  
  
1.0e-04 *  
  
-0.0032  
0  
0.1276  
0
```

```
t =  
  
1.9355
```

```
time =  
  
1.9355
```

```
dx =  
  
1.0e-03 *  
  
0.0034  
0  
-0.1354  
0
```

```
t =  
  
1.9437
```

```
time =  
  
1.9437
```

```
dx =  
  
1.0e-03 *  
  
0.0140  
0  
-0.5523  
0
```

```
t =  
  
1.9540
```

$time =$

1.9540

$dx =$

$1.0e-03 *$

0.0201

0

-0.7898

0

$t =$

1.9540

$time =$

1.9540

$dx =$

$1.0e-04 *$

-0.0115

0

0.4510

0

$t =$

1.8764

$time =$

1.8764

$dx =$

$1.0e-04 *$

-0.0027

0

0.1069

0

$t =$

1.8837

time =

1.8837

$dx =$

$1.0e-04 *$

-0.0033

0

0.1288

0

$t =$

1.9204

time =

1.9204

$dx =$

$1.0e-04 *$

0.0161

0

-0.6318

0

$t =$

1.9270

time =

1.9270

$dx =$

```
1.0e-03 *  
  
0.0064  
0  
-0.2510  
0
```

```
t =  
  
1.9351
```

```
time =  
  
1.9351
```

```
dx =  
  
1.0e-03 *  
  
0.0084  
0  
-0.3293  
0
```

```
t =  
  
1.9351
```

```
time =  
  
1.9351
```

```
dx =  
  
1.0e-04 *  
  
-0.0029  
0  
0.1159  
0
```

```
t =  
  
1.9498
```

```
time =  
  
    1.9498  
  
dx =  
  
    1.0e-05 *  
  
    -0.0125  
      0  
    0.4903  
      0
```

```
t =  
  
    1.9571
```

```
time =  
  
    1.9571
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0150  
      0  
    0.5900  
      0
```

```
t =  
  
    1.9938
```

```
time =  
  
    1.9938
```

```
dx =  
  
    1.0e-04 *  
  
    0.0073  
      0  
    -0.2881  
      0
```

```
t =  
  
    2.0004  
  
time =  
  
    2.0004  
  
dx =  
  
    1.0e-03 *  
  
    0.0029  
    0  
   -0.1144  
    0  
  
t =  
  
    2.0085  
  
time =  
  
    2.0085  
  
dx =  
  
    1.0e-03 *  
  
    0.0038  
    0  
   -0.1501  
    0  
  
t =  
  
    2.0085  
  
time =  
  
    2.0085  
  
dx =  
  
    1.0e-05 *
```

```
-0.0134
      0
    0.5277
      0

t =

    2.0264

time =

    2.0264

dx =

    1.0e-05 *
    -0.0040
      0
    0.1577
      0

t =

    2.0353

time =

    2.0353

dx =

    1.0e-05 *
    -0.0067
      0
    0.2645
      0

t =

    2.0799

time =
```

2.0799

$dx =$

$1.0e-04 *$

0.0064

0

-0.2512

0

$t =$

2.0879

$time =$

2.0879

$dx =$

$1.0e-03 *$

0.0026

0

-0.1019

0

$t =$

2.0978

$time =$

2.0978

$dx =$

$1.0e-03 *$

0.0037

0

-0.1435

0

$t =$

```

2.0978

time =

2.0978

dx =

1.0e-05 *

-0.0192
    0
    0.7535
    0

t =

2.1180

time =

2.1180

dx =

1.0e-05 *

-0.0039
    0
    0.1550
    0

t =

2.1281

time =

2.1281

dx =

1.0e-05 *

-0.0100
```

```

      0
    0.3905
      0

t =

    2.1788

time =

    2.1788

dx =

    1.0e-04 *

    0.0137
         0
   -0.5386
         0

t =

    2.1878

time =

    2.1878

dx =

    1.0e-03 *

    0.0057
         0
   -0.2239
         0

t =

    2.1990

time =

    2.1990

```

```
dx =  
  
1.0e-03 *  
  
0.0085  
0  
-0.3331  
0
```

```
t =  
  
2.1990
```

```
time =  
  
2.1990
```

```
dx =  
  
1.0e-04 *  
  
-0.0060  
0  
0.2365  
0
```

```
t =  
  
2.2175
```

```
time =  
  
2.2175
```

```
dx =  
  
1.0e-05 *  
  
-0.0167  
0  
0.6553  
0
```

```
t =  
  
2.2267
```

$time =$

2.2267

$dx =$

$1.0e-04 *$

-0.0030

0

0.1191

0

$t =$

2.2728

$time =$

2.2728

$dx =$

$1.0e-03 *$

0.0032

0

-0.1245

0

$t =$

2.2810

$time =$

2.2810

$dx =$

$1.0e-03 *$

0.0130

0

-0.5076

```

0

t =

    2.2912

time =

    2.2912

dx =

    1.0e-03 *
    0.0185
         0
   -0.7245
         0

t =

    2.2912

time =

    2.2912

dx =

    1.0e-04 *
   -0.0105
         0
    0.4095
         0

t =

    2.3062

time =

    2.3062

dx =
```

```
1.0e-04 *  
-0.0043  
  0  
 0.1699  
  0
```

```
t =  
2.3137
```

```
time =  
2.3137
```

```
dx =  
1.0e-04 *  
-0.0053  
  0  
 0.2078  
  0
```

```
t =  
2.3510
```

```
time =  
2.3510
```

```
dx =  
1.0e-03 *  
 0.0027  
  0  
-0.1067  
  0
```

```
t =  
2.3576
```

```
time =  
  
    2.3576  
  
dx =  
  
    1.0e-03 *  
  
    0.0108  
    0  
   -0.4242  
    0
```

```
t =  
  
    2.3659
```

```
time =  
  
    2.3659
```

```
dx =  
  
    1.0e-03 *  
  
    0.0143  
    0  
   -0.5591  
    0
```

```
t =  
  
    2.3659
```

```
time =  
  
    2.3659
```

```
dx =  
  
    1.0e-04 *  
  
   -0.0051  
    0  
    0.2011  
    0
```

```
t =  
  
    2.3798  
  
time =  
  
    2.3798  
  
dx =  
  
    1.0e-05 *  
  
    -0.0235  
         0  
    0.9183  
         0
```

```
t =  
  
    2.3868
```

```
time =  
  
    2.3868
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0027  
         0  
    0.1040  
         0
```

```
t =  
  
    2.4215
```

```
time =  
  
    2.4215
```

```
dx =  
  
    1.0e-04 *
```

```

    0.0104
      0
    -0.4057
      0

t =

    2.4276

time =

    2.4276

dx =

    1.0e-03 *
    0.0041
      0
    -0.1613
      0

t =

    2.4353

time =

    2.4353

dx =

    1.0e-03 *
    0.0053
      0
    -0.2076
      0

t =

    2.4353

time =
```

2.4353

$dx =$

$1.0e-05 *$

-0.0173

0

0.6786

0

$t =$

2.4515

$time =$

2.4515

$dx =$

$1.0e-05 *$

-0.0064

0

0.2487

0

$t =$

2.4596

$time =$

2.4596

$dx =$

$1.0e-05 *$

-0.0087

0

0.3401

0

$t =$

```

2.5001

time =

2.5001

dx =

1.0e-04 *

0.0059
0
-0.2312
0

t =

2.5073

time =

2.5073

dx =

1.0e-04 *

0.0236
0
-0.9241
0

t =

2.5163

time =

2.5163

dx =

1.0e-03 *

0.0032
```

```

      0
    -0.1252
      0

t =

    2.5163

time =

    2.5163

dx =

    1.0e-05 *
    -0.0134
      0
    0.5235
      0

t =

    2.5360

time =

    2.5360

dx =

    1.0e-05 *
    -0.0031
      0
    0.1213
      0

t =

    2.5458

time =

    2.5458
```

```
dx =  
  
1.0e-05 *  
  
-0.0068  
0  
0.2678  
0
```

```
t =  
  
2.5949
```

```
time =  
  
2.5949
```

```
dx =  
  
1.0e-04 *  
  
0.0086  
0  
-0.3359  
0
```

```
t =  
  
2.6036
```

```
time =  
  
2.6036
```

```
dx =  
  
1.0e-03 *  
  
0.0035  
0  
-0.1386  
0
```

```
t =  
  
2.6145
```

$time =$

2.6145

$dx =$

$1.0e-03 *$

0.0052

0

-0.2031

0

$t =$

2.6145

$time =$

2.6145

$dx =$

$1.0e-04 *$

-0.0034

0

0.1331

0

$t =$

2.6346

$time =$

2.6346

$dx =$

$1.0e-05 *$

-0.0074

0

0.2899

0

$t =$

2.6446

time =

2.6446

$dx =$

$1.0e-05 *$

-0.0175

0

0.6852

0

$t =$

2.6946

time =

2.6946

$dx =$

$1.0e-04 *$

0.0232

0

-0.9052

0

$t =$

2.7035

time =

2.7035

$dx =$

```
1.0e-03 *  
  
0.0096  
0  
-0.3750  
0
```

```
t =
```

```
2.7146
```

```
time =
```

```
2.7146
```

```
dx =
```

```
1.0e-03 *  
  
0.0142  
0  
-0.5540  
0
```

```
t =
```

```
2.7146
```

```
time =
```

```
2.7146
```

```
dx =
```

```
1.0e-04 *  
  
-0.0097  
0  
0.3792  
0
```

```
t =
```

```
2.7312
```

```
time =  
  
    2.7312  
  
dx =  
  
    1.0e-04 *  
  
    -0.0034  
        0  
    0.1339  
        0
```

```
t =  
  
    2.7394
```

```
time =  
  
    2.7394
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0049  
        0  
    0.1897  
        0
```

```
t =  
  
    2.7808
```

```
time =  
  
    2.7808
```

```
dx =  
  
    1.0e-03 *  
  
    0.0035  
        0  
    -0.1384  
        0
```

```
t =  
  
    2.7882  
  
time =  
  
    2.7882  
  
dx =  
  
    1.0e-03 *  
  
    0.0142  
        0  
    -0.5548  
        0  
  
t =  
  
    2.7974  
  
time =  
  
    2.7974  
  
dx =  
  
    1.0e-03 *  
  
    0.0194  
        0  
    -0.7577  
        0  
  
t =  
  
    2.7974  
  
time =  
  
    2.7974  
  
dx =  
  
    1.0e-04 *
```

```
-0.0085
      0
    0.3313
      0

t =

    2.8113

time =

    2.8113

dx =

    1.0e-04 *
    -0.0039
      0
    0.1515
      0

t =

    2.8182

time =

    2.8182

dx =

    1.0e-04 *
    -0.0044
      0
    0.1714
      0

t =

    2.8530

time =
```

2.8530

$dx =$

$1.0e-04 *$

0.0170

0

-0.6655

0

$t =$

2.8591

$time =$

2.8591

$dx =$

$1.0e-03 *$

0.0068

0

-0.2646

0

$t =$

2.8669

$time =$

2.8669

$dx =$

$1.0e-03 *$

0.0087

0

-0.3405

0

$t =$

```

2.8669

time =

2.8669

dx =

1.0e-04 *

-0.0028
0
0.1112
0

t =

2.8815

time =

2.8815

dx =

1.0e-05 *

-0.0122
0
0.4747
0

t =

2.8889

time =

2.8889

dx =

1.0e-05 *

-0.0145
```

```

      0
    0.5670
      0

t =

    2.9256

time =

    2.9256

dx =

    1.0e-04 *
      0.0069
      0
    -0.2702
      0

t =

    2.9321

time =

    2.9321

dx =

    1.0e-03 *
      0.0028
      0
    -0.1074
      0

t =

    2.9403

time =

    2.9403

```

```
dx =  
  
1.0e-03 *  
  
0.0036  
0  
-0.1405  
0
```

```
t =  
  
2.9403
```

```
time =  
  
2.9403
```

```
dx =  
  
1.0e-05 *  
  
-0.0125  
0  
0.4898  
0
```

```
t =  
  
2.9584
```

```
time =  
  
2.9584
```

```
dx =  
  
1.0e-05 *  
  
-0.0037  
0  
0.1435  
0
```

```
t =  
  
2.9674
```

$time =$

2.9674

$dx =$

$1.0e-05 *$

-0.0063

0

0.2458

0

$t =$

3.0127

$time =$

3.0127

$dx =$

$1.0e-04 *$

0.0061

0

-0.2398

0

$t =$

3.0208

$time =$

3.0208

$dx =$

$1.0e-04 *$

0.0250

0

-0.9739

```

0

t =

3.0308

time =

3.0308

dx =

1.0e-03 *

0.0035
0
-0.1377
0

t =

3.0308

time =

3.0308

dx =

1.0e-05 *

-0.0189
0
0.7388
0

t =

3.0515

time =

3.0515

dx =
```

```
1.0e-05 *  
-0.0037  
  0  
 0.1445  
  0
```

```
t =  
3.0618
```

```
time =  
3.0618
```

```
dx =  
1.0e-05 *  
-0.0099  
  0  
 0.3851  
  0
```

```
t =  
3.1133
```

```
time =  
3.1133
```

```
dx =  
1.0e-04 *  
 0.0141  
  0  
-0.5504  
  0
```

```
t =  
3.1225
```

```
time =  
  
    3.1225  
  
dx =  
  
    1.0e-03 *  
  
    0.0059  
    0  
   -0.2295  
    0
```

```
t =  
  
    3.1339
```

```
time =  
  
    3.1339
```

```
dx =  
  
    1.0e-03 *  
  
    0.0088  
    0  
   -0.3434  
    0
```

```
t =  
  
    3.1339
```

```
time =  
  
    3.1339
```

```
dx =  
  
    1.0e-04 *  
  
   -0.0065  
    0  
    0.2518  
    0
```

```
t =  
  
    3.1525  
  
time =  
  
    3.1525  
  
dx =  
  
    1.0e-05 *  
  
    -0.0178  
        0  
    0.6961  
        0  
  
t =  
  
    3.1617  
  
time =  
  
    3.1617  
  
dx =  
  
    1.0e-04 *  
  
    -0.0033  
        0  
    0.1268  
        0  
  
t =  
  
    3.2081  
  
time =  
  
    3.2081  
  
dx =  
  
    1.0e-03 *
```

```

    0.0034
      0
    -0.1330
      0

t =

    3.2164

time =

    3.2164

dx =

    1.0e-03 *
      0.0139
        0
    -0.5423
        0

t =

    3.2267

time =

    3.2267

dx =

    1.0e-03 *
      0.0199
        0
    -0.7745
        0

t =

    3.2267

time =
```

3.2267

$dx =$

$1.0e-04 *$

-0.0113

0

0.4390

0

$t =$

3.1487

$time =$

3.1487

$dx =$

$1.0e-04 *$

-0.0027

0

0.1064

0

$t =$

3.1561

$time =$

3.1561

$dx =$

$1.0e-04 *$

-0.0033

0

0.1281

0

$t =$

```

3.1931

time =

3.1931

dx =

1.0e-04 *

0.0161
0
-0.6280
0

t =

3.1997

time =

3.1997

dx =

1.0e-03 *

0.0064
0
-0.2495
0

t =

3.2079

time =

3.2079

dx =

1.0e-03 *

0.0084
```

```

      0
    -0.3274
      0

t =

    3.2079

time =

    3.2079

dx =

    1.0e-04 *
    -0.0030
      0
    0.1154
      0

t =

    3.2227

time =

    3.2227

dx =

    1.0e-05 *
    -0.0125
      0
    0.4878
      0

t =

    3.2302

time =

    3.2302

```

```
dx =  
  
1.0e-05 *  
  
-0.0151  
0  
0.5875  
0
```

```
t =  
  
3.2672
```

```
time =  
  
3.2672
```

```
dx =  
  
1.0e-04 *  
  
0.0074  
0  
-0.2876  
0
```

```
t =  
  
3.2737
```

```
time =  
  
3.2737
```

```
dx =  
  
1.0e-03 *  
  
0.0029  
0  
-0.1143  
0
```

```
t =  
  
3.2820
```

$time =$

3.2820

$dx =$

$1.0e-03 *$

0.0038

0

-0.1500

0

$t =$

3.2820

$time =$

3.2820

$dx =$

$1.0e-05 *$

-0.0136

0

0.5285

0

$t =$

3.2999

$time =$

3.2999

$dx =$

$1.0e-05 *$

-0.0041

0

0.1581

```

0

t =
    3.3089

time =
    3.3089

dx =
    1.0e-05 *
    -0.0068
         0
    0.2649
         0

t =
    3.3539

time =
    3.3539

dx =
    1.0e-04 *
    0.0065
         0
   -0.2515
         0

t =
    3.3619

time =
    3.3619

dx =
```

```
1.0e-03 *  
  
0.0026  
0  
-0.1020  
0
```

```
t =  
  
3.3718
```

```
time =  
  
3.3718
```

```
dx =  
  
1.0e-03 *  
  
0.0037  
0  
-0.1437  
0
```

```
t =  
  
3.3718
```

```
time =  
  
3.3718
```

```
dx =  
  
1.0e-05 *  
  
-0.0194  
0  
0.7550  
0
```

```
t =  
  
3.3922
```

```
time =  
  
    3.3922  
  
dx =  
  
    1.0e-05 *  
  
    -0.0040  
        0  
    0.1560  
        0
```

```
t =  
  
    3.4024
```

```
time =  
  
    3.4024
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0100  
        0  
    0.3911  
        0
```

```
t =  
  
    3.4533
```

```
time =  
  
    3.4533
```

```
dx =  
  
    1.0e-04 *  
  
    0.0138  
        0  
    -0.5380  
        0
```

$t =$

3.4623

$time =$

3.4623

$dx =$

$1.0e-03 *$

0.0057

0

-0.2236

0

$t =$

3.4736

$time =$

3.4736

$dx =$

$1.0e-03 *$

0.0085

0

-0.3325

0

$t =$

3.4736

$time =$

3.4736

$dx =$

$1.0e-04 *$

```
-0.0060
      0
    0.2358
      0

t =

    3.4921

time =

    3.4921

dx =

    1.0e-05 *
    -0.0168
      0
    0.6549
      0

t =

    3.5014

time =

    3.5014

dx =

    1.0e-04 *
    -0.0030
      0
    0.1187
      0

t =

    3.5477

time =
```

3.5477

$dx =$

$1.0e-03 *$

0.0032

0

-0.1238

0

$t =$

3.5560

$time =$

3.5560

$dx =$

$1.0e-03 *$

0.0129

0

-0.5045

0

$t =$

3.5663

$time =$

3.5663

$dx =$

$1.0e-03 *$

0.0185

0

-0.7199

0

$t =$

```

3.5663

time =

3.5663

dx =

1.0e-04 *

-0.0104
    0
0.4063
    0

t =

3.5813

time =

3.5813

dx =

1.0e-04 *

-0.0043
    0
0.1686
    0

t =

3.5888

time =

3.5888

dx =

1.0e-04 *

-0.0053
```

```

      0
    0.2062
      0

t =

    3.6263

time =

    3.6263

dx =

    1.0e-03 *

    0.0027
      0
   -0.1060
      0

t =

    3.6330

time =

    3.6330

dx =

    1.0e-03 *

    0.0108
      0
   -0.4212
      0

t =

    3.6413

time =

    3.6413
```

$dx =$

$1.0e-03 *$

0.0143

0

-0.5552

0

$t =$

3.6413

$time =$

3.6413

$dx =$

$1.0e-04 *$

-0.0051

0

0.1999

0

$t =$

3.6553

$time =$

3.6553

$dx =$

$1.0e-05 *$

-0.0234

0

0.9121

0

$t =$

3.6623

$time =$

3.6623

$dx =$

$1.0e-04 *$

-0.0027

0

0.1033

0

$t =$

3.6972

$time =$

3.6972

$dx =$

$1.0e-04 *$

0.0104

0

-0.4045

0

$t =$

3.7034

$time =$

3.7034

$dx =$

$1.0e-03 *$

0.0041

0

-0.1608

```

0

t =
    3.7111

time =
    3.7111

dx =
    1.0e-03 *
    0.0053
    0
   -0.2071
    0

t =
    3.7111

time =
    3.7111

dx =
    1.0e-05 *
   -0.0174
    0
    0.6778
    0

t =
    3.7274

time =
    3.7274

dx =

```

```
1.0e-05 *  
-0.0064  
0  
0.2483  
0
```

```
t =  
3.7355
```

```
time =  
3.7355
```

```
dx =  
1.0e-05 *  
-0.0087  
0  
0.3397  
0
```

```
t =  
3.7762
```

```
time =  
3.7762
```

```
dx =  
1.0e-04 *  
0.0059  
0  
-0.2312  
0
```

```
t =  
3.7834
```

$time =$

3.7834

$dx =$

$1.0e-04 *$

0.0237

0

-0.9244

0

$t =$

3.7924

$time =$

3.7924

$dx =$

$1.0e-03 *$

0.0032

0

-0.1253

0

$t =$

3.7924

$time =$

3.7924

$dx =$

$1.0e-05 *$

-0.0135

0

0.5245

0

```
t =  
  
    3.8122  
  
time =  
  
    3.8122  
  
dx =  
  
    1.0e-05 *  
  
    -0.0031  
        0  
    0.1218  
        0  
  
t =  
  
    3.8220  
  
time =  
  
    3.8220  
  
dx =  
  
    1.0e-05 *  
  
    -0.0069  
        0  
    0.2683  
        0  
  
t =  
  
    3.8713  
  
time =  
  
    3.8713  
  
dx =  
  
    1.0e-04 *
```

```
    0.0086
      0
    -0.3362
      0
```

```
t =

    3.8801
```

```
time =

    3.8801
```

```
dx =

    1.0e-03 *
      0.0036
      0
    -0.1387
      0
```

```
t =

    3.8910
```

```
time =

    3.8910
```

```
dx =

    1.0e-03 *
      0.0052
      0
    -0.2033
      0
```

```
t =

    3.8910
```

```
time =
```

3.8910

$dx =$

$1.0e-04 *$

-0.0034

0

0.1331

0

$t =$

3.9111

$time =$

3.9111

$dx =$

$1.0e-05 *$

-0.0075

0

0.2908

0

$t =$

3.9211

$time =$

3.9211

$dx =$

$1.0e-05 *$

-0.0176

0

0.6852

0

$t =$

```

3.9713

time =

3.9713

dx =

1.0e-04 *

0.0232
0
-0.9030
0

t =

3.9802

time =

3.9802

dx =

1.0e-03 *

0.0096
0
-0.3740
0

t =

3.9913

time =

3.9913

dx =

1.0e-03 *

0.0142
```

```

      0
    -0.5524
      0

t =

    3.9913

time =

    3.9913

dx =

    1.0e-04 *
    -0.0097
      0
    0.3775
      0

t =

    4.0079

time =

    4.0079

dx =

    1.0e-04 *
    -0.0034
      0
    0.1334
      0

t =

    4.0162

time =

    4.0162
```

```
dx =  
  
1.0e-04 *  
  
-0.0049  
0  
0.1889  
0
```

```
t =  
  
4.0578
```

```
time =  
  
4.0578
```

```
dx =  
  
1.0e-03 *  
  
0.0035  
0  
-0.1377  
0
```

```
t =  
  
4.0651
```

```
time =  
  
4.0651
```

```
dx =  
  
1.0e-03 *  
  
0.0142  
0  
-0.5518  
0
```

```
t =  
  
4.0744
```

$time =$

4.0744

$dx =$

$1.0e-03 *$

0.0194

0

-0.7535

0

$t =$

4.0744

$time =$

4.0744

$dx =$

$1.0e-04 *$

-0.0085

0

0.3293

0

$t =$

4.0883

$time =$

4.0883

$dx =$

$1.0e-04 *$

-0.0039

0

0.1506

```

0

t =

4.0953

time =

4.0953

dx =

1.0e-04 *

-0.0044
0
0.1703
0

t =

4.1301

time =

4.1301

dx =

1.0e-04 *

0.0170
0
-0.6628
0

t =

4.1363

time =

4.1363

dx =
```

```
1.0e-03 *  
  
0.0068  
0  
-0.2636  
0
```

```
t =  
  
4.1441
```

```
time =  
  
4.1441
```

```
dx =  
  
1.0e-03 *  
  
0.0087  
0  
-0.3392  
0
```

```
t =  
  
4.1441
```

```
time =  
  
4.1441
```

```
dx =  
  
1.0e-04 *  
  
-0.0028  
0  
0.1109  
0
```

```
t =  
  
4.1588
```

```
time =  
  
    4.1588  
  
dx =  
  
    1.0e-05 *  
  
    -0.0121  
        0  
    0.4728  
        0
```

```
t =  
  
    4.1662
```

```
time =  
  
    4.1662
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0145  
        0  
    0.5651  
        0
```

```
t =  
  
    4.2030
```

```
time =  
  
    4.2030
```

```
dx =  
  
    1.0e-04 *  
  
    0.0069  
        0  
    -0.2700  
        0
```

```
t =  
  
    4.2095  
  
time =  
  
    4.2095  
  
dx =  
  
    1.0e-03 *  
  
    0.0028  
        0  
    -0.1073  
        0
```

```
t =  
  
    4.2177
```

```
time =  
  
    4.2177
```

```
dx =  
  
    1.0e-03 *  
  
    0.0036  
        0  
    -0.1404  
        0
```

```
t =  
  
    4.2177
```

```
time =  
  
    4.2177
```

```
dx =  
  
    1.0e-05 *
```

```
-0.0126
      0
  0.4901
      0

t =

  4.2359

time =

  4.2359

dx =

  1.0e-05 *
-0.0037
      0
  0.1436
      0

t =

  4.2450

time =

  4.2450

dx =

  1.0e-05 *
-0.0063
      0
  0.2460
      0

t =

  4.2904

time =
```

4.2904

$dx =$

$1.0e-04 *$

0.0062

0

-0.2401

0

$t =$

4.2985

$time =$

4.2985

$dx =$

$1.0e-04 *$

0.0250

0

-0.9750

0

$t =$

4.3085

$time =$

4.3085

$dx =$

$1.0e-03 *$

0.0035

0

-0.1379

0

$t =$

```

4.3085

time =

4.3085

dx =

1.0e-05 *

-0.0190
    0
 0.7400
    0

t =

4.3292

time =

4.3292

dx =

1.0e-05 *

-0.0037
    0
 0.1450
    0

t =

4.3395

time =

4.3395

dx =

1.0e-05 *

-0.0099
```

```

      0
    0.3857
      0

t =

    4.3912

time =

    4.3912

dx =

    1.0e-04 *

    0.0141
      0
   -0.5505
      0

t =

    4.4003

time =

    4.4003

dx =

    1.0e-03 *

    0.0059
      0
   -0.2295
      0

t =

    4.4118

time =

    4.4118
```

```
dx =  
  
1.0e-03 *  
  
0.0088  
0  
-0.3434  
0
```

```
t =  
  
4.4118
```

```
time =  
  
4.4118
```

```
dx =  
  
1.0e-04 *  
  
-0.0065  
0  
0.2515  
0
```

```
t =  
  
4.4304
```

```
time =  
  
4.4304
```

```
dx =  
  
1.0e-05 *  
  
-0.0179  
0  
0.6964  
0
```

```
t =  
  
4.4397
```

$time =$

4.4397

$dx =$

$1.0e-04 *$

-0.0033

0

0.1267

0

$t =$

4.4861

$time =$

4.4861

$dx =$

$1.0e-03 *$

0.0034

0

-0.1326

0

$t =$

4.4944

$time =$

4.4944

$dx =$

$1.0e-03 *$

0.0139

0

-0.5406

```

0

t =
    4.5047

time =
    4.5047

dx =
    1.0e-03 *
    0.0198
    0
   -0.7719
    0

t =
    4.5047

time =
    4.5047

dx =
    1.0e-04 *
   -0.0112
    0
    0.4371
    0

t =
    4.4267

time =
    4.4267

dx =

```

```
1.0e-04 *  
-0.0027  
  0  
  0.1063  
  0
```

```
t =  
  
4.4341
```

```
time =  
  
4.4341
```

```
dx =  
  
1.0e-04 *  
-0.0033  
  0  
  0.1280  
  0
```

```
t =  
  
4.4712
```

```
time =  
  
4.4712
```

```
dx =  
  
1.0e-04 *  
  0.0161  
  0  
-0.6270  
  0
```

```
t =  
  
4.4778
```

$time =$

4.4778

$dx =$

$1.0e-03 *$

0.0064

0

-0.2491

0

$t =$

4.4860

$time =$

4.4860

$dx =$

$1.0e-03 *$

0.0084

0

-0.3269

0

$t =$

4.4860

$time =$

4.4860

$dx =$

$1.0e-04 *$

-0.0030

0

0.1152

0

```
t =  
  
    4.5008  
  
time =  
  
    4.5008  
  
dx =  
  
    1.0e-05 *  
  
    -0.0125  
        0  
    0.4870  
        0
```

```
t =  
  
    4.5083
```

```
time =  
  
    4.5083
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0151  
        0  
    0.5865  
        0
```

```
t =  
  
    4.5453
```

```
time =  
  
    4.5453
```

```
dx =  
  
    1.0e-04 *
```

```

    0.0074
      0
    -0.2872
      0

t =

    4.5519

time =

    4.5519

dx =

    1.0e-03 *
      0.0029
      0
    -0.1141
      0

t =

    4.5602

time =

    4.5602

dx =

    1.0e-03 *
      0.0038
      0
    -0.1497
      0

t =

    4.5602

time =
```

4.5602

$\vec{dx} =$

$1.0e-05 *$

-0.0136

0

0.5278

0

$t =$

4.5782

$time =$

4.5782

$\vec{dx} =$

$1.0e-05 *$

-0.0041

0

0.1579

0

$t =$

4.5872

$time =$

4.5872

$\vec{dx} =$

$1.0e-05 *$

-0.0068

0

0.2646

0

$t =$

```

4.6322

time =

4.6322

dx =

1.0e-04 *

0.0065
0
-0.2511
0

t =

4.6402

time =

4.6402

dx =

1.0e-03 *

0.0026
0
-0.1018
0

t =

4.6502

time =

4.6502

dx =

1.0e-03 *

0.0037
```

```

      0
    -0.1435
      0

t =

    4.6502

time =

    4.6502

dx =

    1.0e-05 *
    -0.0194
      0
    0.7542
      0

t =

    4.6706

time =

    4.6706

dx =

    1.0e-05 *
    -0.0040
      0
    0.1558
      0

t =

    4.6808

time =

    4.6808
```

```
dx =  
  
1.0e-05 *  
  
-0.0100  
0  
0.3907  
0
```

```
t =  
  
4.7318
```

```
time =  
  
4.7318
```

```
dx =  
  
1.0e-04 *  
  
0.0138  
0  
-0.5374  
0
```

```
t =  
  
4.7408
```

```
time =  
  
4.7408
```

```
dx =  
  
1.0e-03 *  
  
0.0057  
0  
-0.2233  
0
```

```
t =  
  
4.7522
```

$time =$

4.7522

$dx =$

$1.0e-03 *$

0.0085

0

-0.3321

0

$t =$

4.7522

$time =$

4.7522

$dx =$

$1.0e-04 *$

-0.0061

0

0.2355

0

$t =$

4.7707

$time =$

4.7707

$dx =$

$1.0e-05 *$

-0.0168

0

0.6544

```

0

t =

4.7800

time =

4.7800

dx =

1.0e-04 *
-0.0030
0
0.1186
0

t =

4.8264

time =

4.8264

dx =

1.0e-03 *
0.0032
0
-0.1236
0

t =

4.8347

time =

4.8347

dx =

```

```

1.0e-03 *
0.0130
0
-0.5040
0

```

```

t =
4.8450

```

```

time =
4.8450

```

```

dx =
1.0e-03 *
0.0185
0
-0.7191
0

```

```

t =
4.8450

```

```

time =
4.8450

```

```

dx =
1.0e-04 *
-0.0104
0
0.4059
0

```

```

t =
4.8600

```

```
time =  
  
    4.8600  
  
dx =  
  
    1.0e-04 *  
  
    -0.0043  
        0  
    0.1684  
        0
```

```
t =  
  
    4.8675
```

```
time =  
  
    4.8675
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0053  
        0  
    0.2060  
        0
```

```
t =  
  
    4.9051
```

```
time =  
  
    4.9051
```

```
dx =  
  
    1.0e-03 *  
  
    0.0027  
        0  
    -0.1059  
        0
```

```
t =  
  
    4.9118  
  
time =  
  
    4.9118  
  
dx =  
  
    1.0e-03 *  
  
    0.0108  
        0  
    -0.4208  
        0
```

```
t =  
  
    4.9202
```

```
time =  
  
    4.9202
```

```
dx =  
  
    1.0e-03 *  
  
    0.0143  
        0  
    -0.5546  
        0
```

```
t =  
  
    4.9202
```

```
time =  
  
    4.9202
```

```
dx =  
  
    1.0e-04 *
```

```
-0.0051
      0
    0.1997
      0

t =

    4.9342

time =

    4.9342

dx =

    1.0e-05 *
    -0.0234
      0
    0.9111
      0

t =

    4.9411

time =

    4.9411

dx =

    1.0e-04 *
    -0.0027
      0
    0.1032
      0

t =

    4.9761

time =
```

4.9761

$dx =$

$1.0e-04 *$

0.0104

0

-0.4040

0

$t =$

4.9823

$time =$

4.9823

$dx =$

$1.0e-03 *$

0.0041

0

-0.1606

0

$t =$

4.9901

$time =$

4.9901

$dx =$

$1.0e-03 *$

0.0053

0

-0.2069

0

$t =$

```

4.9901

time =

4.9901

dx =

1.0e-05 *

-0.0174
    0
0.6771
    0

t =

5.0063

time =

5.0063

dx =

1.0e-05 *

-0.0064
    0
0.2480
    0

t =

5.0145

time =

5.0145

dx =

1.0e-05 *

-0.0087
```

```

      0
    0.3394
      0

t =

    5.0552

time =

    5.0552

dx =

    1.0e-04 *
      0.0059
      0
    -0.2309
      0

t =

    5.0624

time =

    5.0624

dx =

    1.0e-04 *
      0.0237
      0
    -0.9233
      0

t =

    5.0715

time =

    5.0715
```

```
dx =  
  
1.0e-03 *  
  
0.0032  
0  
-0.1252  
0
```

```
t =  
  
5.0715
```

```
time =  
  
5.0715
```

```
dx =  
  
1.0e-05 *  
  
-0.0135  
0  
0.5240  
0
```

```
t =  
  
5.0912
```

```
time =  
  
5.0912
```

```
dx =  
  
1.0e-05 *  
  
-0.0031  
0  
0.1216  
0
```

```
t =  
  
5.1011
```

$time =$

5.1011

$dx =$

$1.0e-05 *$

-0.0069

0

0.2680

0

$t =$

5.1505

$time =$

5.1505

$dx =$

$1.0e-04 *$

0.0086

0

-0.3358

0

$t =$

5.1592

$time =$

5.1592

$dx =$

$1.0e-03 *$

0.0036

0

-0.1386

```

0

t =
    5.1702

time =
    5.1702

dx =
    1.0e-03 *
    0.0052
    0
   -0.2031
    0

t =
    5.1702

time =
    5.1702

dx =
    1.0e-04 *
   -0.0034
    0
    0.1330
    0

t =
    5.1903

time =
    5.1903

dx =

```

```

1.0e-05 *
-0.0075
  0
0.2906
  0

```

```

t =
5.2003

```

```

time =
5.2003

```

```

dx =
1.0e-05 *
-0.0176
  0
0.6846
  0

```

```

t =
5.2506

```

```

time =
5.2506

```

```

dx =
1.0e-04 *
0.0232
  0
-0.9022
  0

```

```

t =
5.2595

```

$time =$

5.2595

$dx =$

$1.0e-03 *$

0.0096

0

-0.3737

0

$t =$

5.2707

$time =$

5.2707

$dx =$

$1.0e-03 *$

0.0142

0

-0.5520

0

$t =$

5.2707

$time =$

5.2707

$dx =$

$1.0e-04 *$

-0.0097

0

0.3773

0

$t =$

5.2873

$time =$

5.2873

$dx =$

$1.0e-04 *$

-0.0034

0

0.1334

0

$t =$

5.2956

$time =$

5.2956

$dx =$

$1.0e-04 *$

-0.0049

0

0.1888

0

$t =$

5.3372

$time =$

5.3372

$dx =$

$1.0e-03 *$

```

    0.0035
      0
    -0.1376
      0

t =

    5.3445

time =

    5.3445

dx =

    1.0e-03 *
      0.0142
      0
    -0.5514
      0

t =

    5.3538

time =

    5.3538

dx =

    1.0e-03 *
      0.0194
      0
    -0.7530
      0

t =

    5.3538

time =
```

5.3538

$dx =$

$1.0e-04 *$

-0.0085

0

0.3291

0

$t =$

5.3677

$time =$

5.3677

$dx =$

$1.0e-04 *$

-0.0039

0

0.1505

0

$t =$

5.3747

$time =$

5.3747

$dx =$

$1.0e-04 *$

-0.0044

0

0.1702

0

$t =$

```

5.4096

time =

5.4096

dx =

1.0e-04 *

0.0170
0
-0.6623
0

t =

5.4158

time =

5.4158

dx =

1.0e-03 *

0.0068
0
-0.2633
0

t =

5.4236

time =

5.4236

dx =

1.0e-03 *

0.0087
```

```

      0
    -0.3389
      0

t =

    5.4236

time =

    5.4236

dx =

    1.0e-04 *
    -0.0028
         0
    0.1108
         0

t =

    5.4383

time =

    5.4383

dx =

    1.0e-05 *
    -0.0121
         0
    0.4725
         0

t =

    5.4457

time =

    5.4457
```

```
dx =  
  
1.0e-05 *  
  
-0.0145  
0  
0.5647  
0
```

```
t =  
  
5.4825
```

```
time =  
  
5.4825
```

```
dx =  
  
1.0e-04 *  
  
0.0069  
0  
-0.2697  
0
```

```
t =  
  
5.4891
```

```
time =  
  
5.4891
```

```
dx =  
  
1.0e-03 *  
  
0.0028  
0  
-0.1072  
0
```

```
t =  
  
5.4973
```

$time =$

5.4973

$dx =$

$1.0e-03 *$

0.0036

0

-0.1403

0

$t =$

5.4973

$time =$

5.4973

$dx =$

$1.0e-05 *$

-0.0126

0

0.4897

0

$t =$

5.5155

$time =$

5.5155

$dx =$

$1.0e-05 *$

-0.0037

0

0.1434

```

0

t =

5.5246

time =

5.5246

dx =

1.0e-05 *
-0.0063
0
0.2457
0

t =

5.5700

time =

5.5700

dx =

1.0e-04 *
0.0062
0
-0.2398
0

t =

5.5781

time =

5.5781

dx =
```

```

1.0e-04 *
0.0250
0
-0.9740
0

```

```

t =

5.5882

```

```

time =

5.5882

```

```

dx =

1.0e-03 *
0.0035
0
-0.1378
0

```

```

t =

5.5882

```

```

time =

5.5882

```

```

dx =

1.0e-05 *
-0.0190
0
0.7394
0

```

```

t =

5.6089

```

```
time =  
  
    5.6089  
  
dx =  
  
    1.0e-05 *  
  
    -0.0037  
        0  
    0.1449  
        0
```

```
t =  
  
    5.6192
```

```
time =  
  
    5.6192
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0099  
        0  
    0.3854  
        0
```

```
t =  
  
    5.6709
```

```
time =  
  
    5.6709
```

```
dx =  
  
    1.0e-04 *  
  
    0.0141  
        0  
    -0.5501  
        0
```

```
t =  
  
    5.6801  
  
time =  
  
    5.6801  
  
dx =  
  
    1.0e-03 *  
  
    0.0059  
        0  
    -0.2293  
        0
```

```
t =  
  
    5.6916
```

```
time =  
  
    5.6916
```

```
dx =  
  
    1.0e-03 *  
  
    0.0088  
        0  
    -0.3431  
        0
```

```
t =  
  
    5.6916
```

```
time =  
  
    5.6916
```

```
dx =  
  
    1.0e-04 *
```

```
-0.0065
      0
    0.2514
      0

t =

    5.7102

time =

    5.7102

dx =

    1.0e-05 *
    -0.0179
      0
    0.6959
      0

t =

    5.7195

time =

    5.7195

dx =

    1.0e-04 *
    -0.0033
      0
    0.1266
      0

t =

    5.7660

time =
```

5.7660

$dx =$

$1.0e-03 *$

0.0034

0

-0.1325

0

$t =$

5.7742

$time =$

5.7742

$dx =$

$1.0e-03 *$

0.0139

0

-0.5404

0

$t =$

5.7846

$time =$

5.7846

$dx =$

$1.0e-03 *$

0.0198

0

-0.7715

0

$t =$

```

5.7846

time =

5.7846

dx =

1.0e-04 *
-0.0112
0
0.4369
0

t =

5.7064

time =

5.7064

dx =

1.0e-04 *
-0.0027
0
0.1062
0

t =

5.7139

time =

5.7139

dx =

1.0e-04 *
-0.0033
```

```

      0
    0.1279
      0

t =

    5.7510

time =

    5.7510

dx =

    1.0e-04 *

    0.0161
      0
   -0.6264
      0

t =

    5.7576

time =

    5.7576

dx =

    1.0e-03 *

    0.0064
      0
   -0.2489
      0

t =

    5.7658

time =

    5.7658

```

```
dx =  
  
1.0e-03 *  
  
0.0084  
0  
-0.3266  
0
```

```
t =  
  
5.7658
```

```
time =  
  
5.7658
```

```
dx =  
  
1.0e-04 *  
  
-0.0030  
0  
0.1151  
0
```

```
t =  
  
5.7807
```

```
time =  
  
5.7807
```

```
dx =  
  
1.0e-05 *  
  
-0.0125  
0  
0.4866  
0
```

```
t =  
  
5.7881
```

$time =$

5.7881

$dx =$

$1.0e-05 *$

-0.0151

0

0.5860

0

$t =$

5.8252

$time =$

5.8252

$dx =$

$1.0e-04 *$

0.0074

0

-0.2869

0

$t =$

5.8318

$time =$

5.8318

$dx =$

$1.0e-03 *$

0.0029

0

-0.1140

```

0

t =

5.8401

time =

5.8401

dx =

1.0e-03 *

0.0038
0
-0.1496
0

t =

5.8401

time =

5.8401

dx =

1.0e-05 *

-0.0136
0
0.5273
0

t =

5.8581

time =

5.8581

dx =
```

```
1.0e-05 *  
-0.0041  
  0  
 0.1577  
  0
```

```
t =  
5.8671
```

```
time =  
5.8671
```

```
dx =  
1.0e-05 *  
-0.0068  
  0  
 0.2643  
  0
```

```
t =  
5.9122
```

```
time =  
5.9122
```

```
dx =  
1.0e-04 *  
 0.0065  
  0  
-0.2509  
  0
```

```
t =  
5.9202
```

```
time =  
  
    5.9202  
  
dx =  
  
    1.0e-03 *  
  
    0.0026  
    0  
   -0.1018  
    0
```

```
t =  
  
    5.9302
```

```
time =  
  
    5.9302
```

```
dx =  
  
    1.0e-03 *  
  
    0.0037  
    0  
   -0.1434  
    0
```

```
t =  
  
    5.9302
```

```
time =  
  
    5.9302
```

```
dx =  
  
    1.0e-05 *  
  
   -0.0194  
    0  
    0.7537  
    0
```

```
t =  
  
    5.9506  
  
time =  
  
    5.9506  
  
dx =  
  
    1.0e-05 *  
  
    -0.0040  
         0  
    0.1557  
         0
```

```
t =  
  
    5.9608
```

```
time =  
  
    5.9608
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0100  
         0  
    0.3905  
         0
```

```
t =  
  
    6.0118
```

```
time =  
  
    6.0118
```

```
dx =  
  
    1.0e-04 *
```

```

    0.0138
      0
    -0.5372
      0

t =

    6.0209

time =

    6.0209

dx =

    1.0e-03 *
      0.0057
      0
    -0.2233
      0

t =

    6.0322

time =

    6.0322

dx =

    1.0e-03 *
      0.0085
      0
    -0.3320
      0

t =

    6.0322

time =
```

6.0322

$dx =$

$1.0e-04 *$

-0.0061

0

0.2355

0

$t =$

6.0508

$time =$

6.0508

$dx =$

$1.0e-05 *$

-0.0168

0

0.6543

0

$t =$

6.0601

$time =$

6.0601

$dx =$

$1.0e-04 *$

-0.0030

0

0.1186

0

$t =$

```

        6.1065

time =

        6.1065

dx =

1.0e-03 *

    0.0032
         0
   -0.1236
         0

t =

        6.1148

time =

        6.1148

dx =

1.0e-03 *

    0.0130
         0
   -0.5039
         0

t =

        6.1251

time =

        6.1251

dx =

1.0e-03 *

    0.0185
```

```

      0
    -0.7190
      0

t =

    6.1251

time =

    6.1251

dx =

    1.0e-04 *
    -0.0104
         0
    0.4059
         0

t =

    6.1401

time =

    6.1401

dx =

    1.0e-04 *
    -0.0043
         0
    0.1684
         0

t =

    6.1477

time =

    6.1477
```

```
dx =  
  
1.0e-04 *  
  
-0.0053  
0  
0.2060  
0
```

```
t =  
  
6.1853
```

```
time =  
  
6.1853
```

```
dx =  
  
1.0e-03 *  
  
0.0027  
0  
-0.1058  
0
```

```
t =  
  
6.1920
```

```
time =  
  
6.1920
```

```
dx =  
  
1.0e-03 *  
  
0.0108  
0  
-0.4206  
0
```

```
t =  
  
6.2003
```

$time =$

6.2003

$dx =$

$1.0e-03 *$

0.0143

0

-0.5544

0

$t =$

6.2003

$time =$

6.2003

$dx =$

$1.0e-04 *$

-0.0051

0

0.1996

0

$t =$

6.2143

$time =$

6.2143

$dx =$

$1.0e-05 *$

-0.0234

0

0.9107

0

$t =$

6.2213

$time =$

6.2213

$dx =$

$1.0e-04 *$

-0.0027

0

0.1032

0

$t =$

6.2563

$time =$

6.2563

$dx =$

$1.0e-04 *$

0.0104

0

-0.4037

0

$t =$

6.2625

$time =$

6.2625

$dx =$

```

1.0e-03 *
0.0041
0
-0.1605
0

```

```

t =
6.2703

```

```

time =
6.2703

```

```

dx =
1.0e-03 *
0.0053
0
-0.2067
0

```

```

t =
6.2703

```

```

time =
6.2703

```

```

dx =
1.0e-05 *
-0.0174
0
0.6765
0

```

```

t =
6.2866

```

```
time =  
  
    6.2866  
  
dx =  
  
    1.0e-05 *  
  
    -0.0064  
      0  
    0.2478  
      0
```

```
t =  
  
    6.2947
```

```
time =  
  
    6.2947
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0087  
      0  
    0.3391  
      0
```

```
t =  
  
    6.3355
```

```
time =  
  
    6.3355
```

```
dx =  
  
    1.0e-04 *  
  
    0.0059  
      0  
    -0.2308  
      0
```

```
t =  
  
    6.3427  
  
time =  
  
    6.3427  
  
dx =  
  
    1.0e-04 *  
  
    0.0237  
        0  
    -0.9226  
        0  
  
t =  
  
    6.3518  
  
time =  
  
    6.3518  
  
dx =  
  
    1.0e-03 *  
  
    0.0032  
        0  
    -0.1251  
        0  
  
t =  
  
    6.3518  
  
time =  
  
    6.3518  
  
dx =  
  
    1.0e-05 *
```

```
-0.0135
      0
    0.5236
      0

t =

    6.3715

time =

    6.3715

dx =

    1.0e-05 *
    -0.0031
      0
    0.1215
      0

t =

    6.3814

time =

    6.3814

dx =

    1.0e-05 *
    -0.0069
      0
    0.2678
      0

t =

    6.4308

time =
```

6.4308

$dx =$

$1.0e-04 *$

0.0086

0

-0.3356

0

$t =$

6.4396

$time =$

6.4396

$dx =$

$1.0e-03 *$

0.0036

0

-0.1385

0

$t =$

6.4505

$time =$

6.4505

$dx =$

$1.0e-03 *$

0.0052

0

-0.2030

0

$t =$

```

        6.4505

time =

        6.4505

dx =

1.0e-04 *

-0.0034
         0
    0.1329
         0

t =

        6.4706

time =

        6.4706

dx =

1.0e-05 *

-0.0075
         0
    0.2904
         0

t =

        6.4807

time =

        6.4807

dx =

1.0e-05 *

-0.0176

```

```

        0
    0.6844
        0

t =

    6.5309

time =

    6.5309

dx =

    1.0e-04 *

    0.0232
         0
   -0.9021
         0

t =

    6.5399

time =

    6.5399

dx =

    1.0e-03 *

    0.0096
         0
   -0.3737
         0

t =

    6.5511

time =

    6.5511

```

```
dx =  
  
1.0e-03 *  
  
0.0142  
0  
-0.5519  
0
```

```
t =  
  
6.5511
```

```
time =  
  
6.5511
```

```
dx =  
  
1.0e-04 *  
  
-0.0097  
0  
0.3773  
0
```

```
t =  
  
6.5677
```

```
time =  
  
6.5677
```

```
dx =  
  
1.0e-04 *  
  
-0.0034  
0  
0.1334  
0
```

```
t =  
  
6.5760
```

$time =$

6.5760

$dx =$

$1.0e-04 *$

-0.0049

0

0.1888

0

$t =$

6.6176

$time =$

6.6176

$dx =$

$1.0e-03 *$

0.0035

0

-0.1376

0

$t =$

6.6250

$time =$

6.6250

$dx =$

$1.0e-03 *$

0.0142

0

-0.5513

```

0

t =

6.6342

time =

6.6342

dx =

1.0e-03 *

0.0194
0
-0.7528
0

t =

6.6342

time =

6.6342

dx =

1.0e-04 *

-0.0085
0
0.3291
0

t =

6.6482

time =

6.6482

dx =

```

```
1.0e-04 *  
-0.0039  
  0  
  0.1505  
  0
```

```
t =  
  
6.6552
```

```
time =  
  
6.6552
```

```
dx =  
  
1.0e-04 *  
-0.0044  
  0  
  0.1702  
  0
```

```
t =  
  
6.6901
```

```
time =  
  
6.6901
```

```
dx =  
  
1.0e-04 *  
  0.0170  
  0  
-0.6619  
  0
```

```
t =  
  
6.6963
```

$time =$

6.6963

$dx =$

$1.0e-03 *$

0.0068

0

-0.2632

0

$t =$

6.7040

$time =$

6.7040

$dx =$

$1.0e-03 *$

0.0087

0

-0.3387

0

$t =$

6.7040

$time =$

6.7040

$dx =$

$1.0e-04 *$

-0.0028

0

0.1107

0

```
t =  
  
    6.7188  
  
time =  
  
    6.7188  
  
dx =  
  
1.0e-05 *  
  
-0.0121  
    0  
    0.4723  
    0  
  
t =  
  
    6.7262  
  
time =  
  
    6.7262  
  
dx =  
  
1.0e-05 *  
  
-0.0145  
    0  
    0.5644  
    0  
  
t =  
  
    6.7630  
  
time =  
  
    6.7630  
  
dx =  
  
1.0e-04 *
```

```

    0.0069
      0
    -0.2696
      0

t =

    6.7696

time =

    6.7696

dx =

    1.0e-03 *
      0.0028
      0
    -0.1071
      0

t =

    6.7778

time =

    6.7778

dx =

    1.0e-03 *
      0.0036
      0
    -0.1402
      0

t =

    6.7778

time =
```

6.7778

$dx =$

$1.0e-05 *$

-0.0126

0

0.4893

0

$t =$

6.7960

$time =$

6.7960

$dx =$

$1.0e-05 *$

-0.0037

0

0.1433

0

$t =$

6.8051

$time =$

6.8051

$dx =$

$1.0e-05 *$

-0.0063

0

0.2456

0

$t =$

```

6.8506

time =

6.8506

dx =

1.0e-04 *

0.0062
0
-0.2397
0

t =

6.8586

time =

6.8586

dx =

1.0e-04 *

0.0250
0
-0.9734
0

t =

6.8688

time =

6.8688

dx =

1.0e-03 *

0.0035
```

```

      0
    -0.1377
      0

t =

    6.8688

time =

    6.8688

dx =

    1.0e-05 *
    -0.0190
      0
    0.7390
      0

t =

    6.8894

time =

    6.8894

dx =

    1.0e-05 *
    -0.0037
      0
    0.1448
      0

t =

    6.8998

time =

    6.8998
```

```
dx =  
  
1.0e-05 *  
  
-0.0099  
0  
0.3852  
0
```

```
t =  
  
6.9515
```

```
time =  
  
6.9515
```

```
dx =  
  
1.0e-04 *  
  
0.0141  
0  
-0.5499  
0
```

```
t =  
  
6.9607
```

```
time =  
  
6.9607
```

```
dx =  
  
1.0e-03 *  
  
0.0059  
0  
-0.2292  
0
```

```
t =  
  
6.9722
```

$time =$

6.9722

$dx =$

$1.0e-03 *$

0.0088

0

-0.3430

0

$t =$

6.9722

$time =$

6.9722

$dx =$

$1.0e-04 *$

-0.0065

0

0.2513

0

$t =$

6.9908

$time =$

6.9908

$dx =$

$1.0e-05 *$

-0.0179

0

0.6958

```

0

t =

7.0001

time =

7.0001

dx =

1.0e-04 *
-0.0033
0
0.1266
0

t =

7.0466

time =

7.0466

dx =

1.0e-03 *
0.0034
0
-0.1325
0

t =

7.0549

time =

7.0549

dx =
```

```
1.0e-03 *  
0.0139  
0  
-0.5403  
0
```

```
t =  
7.0652
```

```
time =  
7.0652
```

```
dx =  
1.0e-03 *  
0.0198  
0  
-0.7715  
0
```

```
t =  
7.0652
```

```
time =  
7.0652
```

```
dx =  
1.0e-04 *  
-0.0112  
0  
0.4369  
0
```

```
t =  
6.9870
```

```
time =  
  
    6.9870  
  
dx =  
  
    1.0e-04 *  
  
    -0.0027  
      0  
    0.1062  
      0
```

```
t =  
  
    6.9945
```

```
time =  
  
    6.9945
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0033  
      0  
    0.1279  
      0
```

```
t =  
  
    7.0316
```

```
time =  
  
    7.0316
```

```
dx =  
  
    1.0e-04 *  
  
    0.0161  
      0  
    -0.6262  
      0
```

```
t =  
  
    7.0382  
  
time =  
  
    7.0382  
  
dx =  
  
    1.0e-03 *  
  
    0.0064  
        0  
    -0.2488  
        0
```

```
t =  
  
    7.0465
```

```
time =  
  
    7.0465
```

```
dx =  
  
    1.0e-03 *  
  
    0.0084  
        0  
    -0.3265  
        0
```

```
t =  
  
    7.0465
```

```
time =  
  
    7.0465
```

```
dx =  
  
    1.0e-04 *
```

```
-0.0030
      0
    0.1151
      0

t =

    7.0613

time =

    7.0613

dx =

    1.0e-05 *
    -0.0125
      0
    0.4864
      0

t =

    7.0687

time =

    7.0687

dx =

    1.0e-05 *
    -0.0151
      0
    0.5857
      0

t =

    7.1059

time =
```

7.1059

$dx =$

$1.0e-04 *$

0.0074

0

-0.2867

0

$t =$

7.1125

$time =$

7.1125

$dx =$

$1.0e-03 *$

0.0029

0

-0.1139

0

$t =$

7.1207

$time =$

7.1207

$dx =$

$1.0e-03 *$

0.0038

0

-0.1495

0

$t =$

```

7.1207

time =

7.1207

dx =

1.0e-05 *

-0.0136
    0
0.5269
    0

t =

7.1388

time =

7.1388

dx =

1.0e-05 *

-0.0041
    0
0.1576
    0

t =

7.1478

time =

7.1478

dx =

1.0e-05 *

-0.0068
```

```

        0
    0.2641
        0

t =

    7.1929

time =

    7.1929

dx =

    1.0e-04 *

    0.0065
         0
   -0.2508
         0

t =

    7.2009

time =

    7.2009

dx =

    1.0e-03 *

    0.0026
         0
   -0.1017
         0

t =

    7.2109

time =

    7.2109

```

```
dx =  
  
1.0e-03 *  
  
0.0037  
0  
-0.1433  
0
```

```
t =  
  
7.2109
```

```
time =  
  
7.2109
```

```
dx =  
  
1.0e-05 *  
  
-0.0194  
0  
0.7533  
0
```

```
t =  
  
7.2313
```

```
time =  
  
7.2313
```

```
dx =  
  
1.0e-05 *  
  
-0.0040  
0  
0.1556  
0
```

```
t =  
  
7.2415
```

$time =$

7.2415

$dx =$

$1.0e-05 *$

-0.0100

0

0.3903

0

$t =$

7.2926

$time =$

7.2926

$dx =$

$1.0e-04 *$

0.0138

0

-0.5370

0

$t =$

7.3016

$time =$

7.3016

$dx =$

$1.0e-03 *$

0.0057

0

-0.2232

```

0

t =

    7.3130

time =

    7.3130

dx =

    1.0e-03 *
    0.0085
    0
   -0.3319
    0

t =

    7.3130

time =

    7.3130

dx =

    1.0e-04 *
   -0.0061
    0
    0.2355
    0

t =

    7.3316

time =

    7.3316

dx =
```

```
1.0e-05 *  
  
-0.0168  
  0  
0.6542  
  0
```

```
t =  
  
7.3409
```

```
time =  
  
7.3409
```

```
dx =  
  
1.0e-04 *  
  
-0.0031  
  0  
0.1186  
  0
```

```
t =  
  
7.3873
```

```
time =  
  
7.3873
```

```
dx =  
  
1.0e-03 *  
  
0.0032  
  0  
-0.1236  
  0
```

```
t =  
  
7.3956
```

$time =$

7.3956

$dx =$

$1.0e-03 *$

0.0130

0

-0.5039

0

$t =$

7.4059

$time =$

7.4059

$dx =$

$1.0e-03 *$

0.0185

0

-0.7191

0

$t =$

7.4059

$time =$

7.4059

$dx =$

$1.0e-04 *$

-0.0104

0

0.4059

0

```
t =  
  
    7.4209  
  
time =  
  
    7.4209  
  
dx =  
  
    1.0e-04 *  
  
    -0.0043  
        0  
    0.1685  
        0
```

```
t =  
  
    7.4285
```

```
time =  
  
    7.4285
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0053  
        0  
    0.2060  
        0
```

```
t =  
  
    7.4661
```

```
time =  
  
    7.4661
```

```
dx =  
  
    1.0e-03 *
```

```

    0.0027
      0
    -0.1058
      0

t =

    7.4728

time =

    7.4728

dx =

    1.0e-03 *
      0.0108
      0
    -0.4206
      0

t =

    7.4812

time =

    7.4812

dx =

    1.0e-03 *
      0.0143
      0
    -0.5543
      0

t =

    7.4812

time =
```

7.4812

$\dot{dx} =$

$1.0e-04 *$

-0.0051

0

0.1995

0

$t =$

7.4951

$time =$

7.4951

$\dot{dx} =$

$1.0e-05 *$

-0.0234

0

0.9107

0

$t =$

7.5021

$time =$

7.5021

$\dot{dx} =$

$1.0e-04 *$

-0.0027

0

0.1032

0

$t =$

```

7.5371

time =

7.5371

dx =

1.0e-04 *

0.0104
0
-0.4035
0

t =

7.5433

time =

7.5433

dx =

1.0e-03 *

0.0041
0
-0.1605
0

t =

7.5511

time =

7.5511

dx =

1.0e-03 *

0.0053
```

```

      0
    -0.2066
      0

t =

    7.5511

time =

    7.5511

dx =

    1.0e-05 *
    -0.0174
      0
    0.6762
      0

t =

    7.5674

time =

    7.5674

dx =

    1.0e-05 *
    -0.0064
      0
    0.2477
      0

t =

    7.5756

time =

    7.5756
```

$dx =$

$1.0e-05 *$
 -0.0087
 0
 0.3389
 0

$t =$

7.6163

$time =$

7.6163

$dx =$

$1.0e-04 *$
 0.0059
 0
 -0.2306
 0

$t =$

7.6236

$time =$

7.6236

$dx =$

$1.0e-04 *$
 0.0237
 0
 -0.9220
 0

$t =$

7.6326

$time =$

7.6326

$dx =$

$1.0e-03 *$

0.0032

0

-0.1250

0

$t =$

7.6326

$time =$

7.6326

$dx =$

$1.0e-05 *$

-0.0135

0

0.5232

0

$t =$

7.6524

$time =$

7.6524

$dx =$

$1.0e-05 *$

-0.0031

0

0.1214

0

$t =$

7.6623

$time =$

7.6623

$dx =$

$1.0e-05 *$

-0.0069

0

0.2677

0

$t =$

7.7117

$time =$

7.7117

$dx =$

$1.0e-04 *$

0.0086

0

-0.3355

0

$t =$

7.7205

$time =$

7.7205

$dx =$

```

1.0e-03 *
0.0036
0
-0.1384
0

```

```

t =
7.7314

```

```

time =
7.7314

```

```

dx =
1.0e-03 *
0.0052
0
-0.2029
0

```

```

t =
7.7314

```

```

time =
7.7314

```

```

dx =
1.0e-04 *
-0.0034
0
0.1329
0

```

```

t =
7.7515

```

```
time =  
  
    7.7515  
  
dx =  
  
    1.0e-05 *  
  
    -0.0075  
      0  
    0.2903  
      0
```

```
t =  
  
    7.7616
```

```
time =  
  
    7.7616
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0176  
      0  
    0.6842  
      0
```

```
t =  
  
    7.8119
```

```
time =  
  
    7.8119
```

```
dx =  
  
    1.0e-04 *  
  
    0.0232  
      0  
    -0.9020  
      0
```

```
t =  
  
    7.8208  
  
time =  
  
    7.8208  
  
dx =  
  
    1.0e-03 *  
  
    0.0096  
        0  
    -0.3736  
        0
```

```
t =  
  
    7.8320
```

```
time =  
  
    7.8320
```

```
dx =  
  
    1.0e-03 *  
  
    0.0142  
        0  
    -0.5519  
        0
```

```
t =  
  
    7.8320
```

```
time =  
  
    7.8320
```

```
dx =  
  
    1.0e-04 *
```

```
-0.0097
      0
  0.3773
      0
```

```
t =

      7.8486
```

```
time =

      7.8486
```

```
dx =

  1.0e-04 *
-0.0034
      0
  0.1334
      0
```

```
t =

      7.8569
```

```
time =

      7.8569
```

```
dx =

  1.0e-04 *
-0.0049
      0
  0.1888
      0
```

```
t =

      7.8985
```

```
time =
```

7.8985

$dx =$

$1.0e-03 *$

0.0035

0

-0.1376

0

$t =$

7.9059

$time =$

7.9059

$dx =$

$1.0e-03 *$

0.0142

0

-0.5514

0

$t =$

7.9152

$time =$

7.9152

$dx =$

$1.0e-03 *$

0.0194

0

-0.7529

0

$t =$

```

7.9152

time =

7.9152

dx =

1.0e-04 *
-0.0085
0
0.3291
0

t =

7.9291

time =

7.9291

dx =

1.0e-04 *
-0.0039
0
0.1505
0

t =

7.9361

time =

7.9361

dx =

1.0e-04 *
-0.0044
```

```

      0
    0.1702
      0

t =

    7.9710

time =

    7.9710

dx =

    1.0e-04 *

    0.0170
      0
   -0.6618
      0

t =

    7.9772

time =

    7.9772

dx =

    1.0e-03 *

    0.0068
      0
   -0.2632
      0

t =

    7.9850

time =

    7.9850
```

```
dx =  
  
1.0e-03 *  
  
0.0087  
0  
-0.3387  
0
```

```
t =  
  
7.9850
```

```
time =  
  
7.9850
```

```
dx =  
  
1.0e-04 *  
  
-0.0028  
0  
0.1107  
0
```

```
t =  
  
7.9998
```

```
time =  
  
7.9998
```

```
dx =  
  
1.0e-05 *  
  
-0.0122  
0  
0.4722  
0
```

```
t =  
  
8.0071
```

$time =$

8.0071

$dx =$

$1.0e-05 *$

-0.0145

0

0.5643

0

$t =$

8.0440

$time =$

8.0440

$dx =$

$1.0e-04 *$

0.0069

0

-0.2695

0

$t =$

8.0506

$time =$

8.0506

$dx =$

$1.0e-03 *$

0.0028

0

-0.1070

```

0

t =

8.0588

time =

8.0588

dx =

1.0e-03 *

0.0036
0
-0.1402
0

t =

8.0588

time =

8.0588

dx =

1.0e-05 *

-0.0126
0
0.4891
0

t =

8.0770

time =

8.0770

dx =
```

```
1.0e-05 *  
-0.0037  
  0  
 0.1433  
  0
```

```
t =  
  
8.0861
```

```
time =  
  
8.0861
```

```
dx =  
  
1.0e-05 *  
-0.0063  
  0  
 0.2454  
  0
```

```
t =  
  
8.1316
```

```
time =  
  
8.1316
```

```
dx =  
  
1.0e-04 *  
 0.0062  
  0  
-0.2396  
  0
```

```
t =  
  
8.1397
```

```
time =  
    8.1397  
  
dx =  
    1.0e-04 *  
    0.0250  
    0  
   -0.9729  
    0
```

```
t =  
    8.1498
```

```
time =  
    8.1498
```

```
dx =  
    1.0e-03 *  
    0.0035  
    0  
   -0.1376  
    0
```

```
t =  
    8.1498
```

```
time =  
    8.1498
```

```
dx =  
    1.0e-05 *  
   -0.0190  
    0  
    0.7387  
    0
```

```
t =  
  
      8.1705  
  
time =  
  
      8.1705  
  
dx =  
  
1.0e-05 *  
  
-0.0037  
      0  
      0.1447  
      0  
  
t =  
  
      8.1808  
  
time =  
  
      8.1808  
  
dx =  
  
1.0e-05 *  
  
-0.0099  
      0  
      0.3850  
      0  
  
t =  
  
      8.2325  
  
time =  
  
      8.2325  
  
dx =  
  
1.0e-04 *
```

```

    0.0141
      0
    -0.5497
      0

t =

    8.2417

time =

    8.2417

dx =

    1.0e-03 *
    0.0059
      0
    -0.2292
      0

t =

    8.2532

time =

    8.2532

dx =

    1.0e-03 *
    0.0088
      0
    -0.3429
      0

t =

    8.2532

time =
```

8.2532

$dx =$

$1.0e-04 *$

-0.0065

0

0.2513

0

$t =$

8.2718

$time =$

8.2718

$dx =$

$1.0e-05 *$

-0.0179

0

0.6957

0

$t =$

8.2812

$time =$

8.2812

$dx =$

$1.0e-04 *$

-0.0033

0

0.1266

0

$t =$

```

8.3277

time =

8.3277

dx =

1.0e-03 *

0.0034
0
-0.1325
0

t =

8.3360

time =

8.3360

dx =

1.0e-03 *

0.0139
0
-0.5404
0

t =

8.3463

time =

8.3463

dx =

1.0e-03 *

0.0199
```

```

      0
    -0.7715
      0

t =

    8.3463

time =

    8.3463

dx =

    1.0e-04 *
    -0.0112
         0
    0.4370
         0

t =

    8.2681

time =

    8.2681

dx =

    1.0e-04 *
    -0.0027
         0
    0.1062
         0

t =

    8.2755

time =

    8.2755
```

```
dx =  
  
1.0e-04 *  
  
-0.0033  
0  
0.1279  
0
```

```
t =  
  
8.3127
```

```
time =  
  
8.3127
```

```
dx =  
  
1.0e-04 *  
  
0.0161  
0  
-0.6260  
0
```

```
t =  
  
8.3193
```

```
time =  
  
8.3193
```

```
dx =  
  
1.0e-03 *  
  
0.0064  
0  
-0.2487  
0
```

```
t =  
  
8.3275
```

$time =$

8.3275

$dx =$

$1.0e-03 *$

0.0084

0

-0.3264

0

$t =$

8.3275

$time =$

8.3275

$dx =$

$1.0e-04 *$

-0.0030

0

0.1150

0

$t =$

8.3424

$time =$

8.3424

$dx =$

$1.0e-05 *$

-0.0125

0

0.4863

0

$t =$

8.3498

$time =$

8.3498

$dx =$

$1.0e-05 *$

-0.0151

0

0.5856

0

$t =$

8.3870

$time =$

8.3870

$dx =$

$1.0e-04 *$

0.0074

0

-0.2866

0

$t =$

8.3936

$time =$

8.3936

$dx =$

```

1.0e-03 *
0.0029
0
-0.1139
0

```

```

t =

8.4018

```

```

time =

8.4018

```

```

dx =

1.0e-03 *
0.0038
0
-0.1494
0

```

```

t =

8.4018

```

```

time =

8.4018

```

```

dx =

1.0e-05 *
-0.0136
0
0.5266
0

```

```

t =

8.4198

```

```
time =  
  
    8.4198  
  
dx =  
  
    1.0e-05 *  
  
    -0.0041  
        0  
    0.1575  
        0
```

```
t =  
  
    8.4289
```

```
time =  
  
    8.4289
```

```
dx =  
  
    1.0e-05 *  
  
    -0.0068  
        0  
    0.2640  
        0
```

```
t =  
  
    8.4740
```

```
time =  
  
    8.4740
```

```
dx =  
  
    1.0e-04 *  
  
    0.0065  
        0  
    -0.2507  
        0
```

```
t =  
  
      8.4820  
  
time =  
  
      8.4820  
  
dx =  
  
1.0e-03 *  
  
      0.0026  
      0  
     -0.1016  
      0
```

```
t =  
  
      8.4920
```

```
time =  
  
      8.4920
```

```
dx =  
  
1.0e-03 *  
  
      0.0037  
      0  
     -0.1433  
      0
```

```
t =  
  
      8.4920
```

```
time =  
  
      8.4920
```

```
dx =  
  
1.0e-05 *
```

```
-0.0194
      0
    0.7531
      0

t =

    8.5124

time =

    8.5124

dx =

    1.0e-05 *
    -0.0040
      0
    0.1555
      0

t =

    8.5226

time =

    8.5226

dx =

    1.0e-05 *
    -0.0100
      0
    0.3902
      0

t =

    8.5737

time =
```

8.5737

$\dot{dx} =$

$1.0e-04 *$

0.0138

0

-0.5369

0

$t =$

8.5828

$time =$

8.5828

$\dot{dx} =$

$1.0e-03 *$

0.0057

0

-0.2232

0

$t =$

8.5941

$time =$

8.5941

$\dot{dx} =$

$1.0e-03 *$

0.0085

0

-0.3319

0

$t =$

```

      8.5941

time =

      8.5941

dx =

1.0e-04 *

-0.0061
      0
      0.2355
      0

t =

      8.6127

time =

      8.6127

dx =

1.0e-05 *

-0.0168
      0
      0.6542
      0

t =

      8.6220

time =

      8.6220

dx =

1.0e-04 *

-0.0031
```

```

      0
    0.1186
      0

t =

    8.6685

time =

    8.6685

dx =

    1.0e-03 *

    0.0032
      0
   -0.1236
      0

t =

    8.6767

time =

    8.6767

dx =

    1.0e-03 *

    0.0130
      0
   -0.5039
      0

t =

    8.6870

time =

    8.6870

```

```
dx =  
  
1.0e-03 *  
  
0.0185  
0  
-0.7191  
0
```

```
t =  
  
8.6870
```

```
time =  
  
8.6870
```

```
dx =  
  
1.0e-04 *  
  
-0.0104  
0  
0.4060  
0
```

```
t =  
  
8.7021
```

```
time =  
  
8.7021
```

```
dx =  
  
1.0e-04 *  
  
-0.0043  
0  
0.1685  
0
```

```
t =  
  
8.7096
```

$time =$

8.7096

$dx =$

$1.0e-04 *$

-0.0053

0

0.2060

0

$t =$

8.7473

$time =$

8.7473

$dx =$

$1.0e-03 *$

0.0027

0

-0.1058

0

$t =$

8.7540

$time =$

8.7540

$dx =$

$1.0e-03 *$

0.0108

0

-0.4205

```

0

t =

8.7623

time =

8.7623

dx =

1.0e-03 *

0.0143
0
-0.5543
0

t =

8.7623

time =

8.7623

dx =

1.0e-04 *

-0.0051
0
0.1995
0

t =

8.7763

time =

8.7763

dx =
```

```

1.0e-05 *
-0.0234
  0
0.9107
  0

```

```

t =

8.7833

```

```

time =

8.7833

```

```

dx =

1.0e-04 *
-0.0027
  0
0.1032
  0

```

```

t =

8.8183

```

```

time =

8.8183

```

```

dx =

1.0e-04 *
0.0104
  0
-0.4034
  0

```

```

t =

8.8245

```

```
time =  
  
      8.8245  
  
dx =  
  
1.0e-03 *  
  
      0.0041  
      0  
     -0.1604  
      0
```

```
t =  
  
      8.8323
```

```
time =  
  
      8.8323
```

```
dx =  
  
1.0e-03 *  
  
      0.0053  
      0  
     -0.2065  
      0
```

```
t =  
  
      8.8323
```

```
time =  
  
      8.8323
```

```
dx =  
  
1.0e-05 *  
  
     -0.0174  
      0  
      0.6760  
      0
```

$t =$

8.8486

$time =$

8.8486

$dx =$

$1.0e-05 *$

-0.0064

0

0.2476

0

$t =$

8.8567

$time =$

8.8567

$dx =$

$1.0e-05 *$

-0.0087

0

0.3388

0

$t =$

8.8975

$time =$

8.8975

$dx =$

$1.0e-04 *$

```
    0.0059
      0
  -0.2305
      0
```

```
t =

    8.9047
```

```
time =

    8.9047
```

```
dx =

    1.0e-04 *
    0.0237
      0
  -0.9217
      0
```

```
t =

    8.9138
```

```
time =

    8.9138
```

```
dx =

    1.0e-03 *
    0.0032
      0
  -0.1249
      0
```

```
t =

    8.9138
```

```
time =
```

8.9138

$dx =$

$1.0e-05 *$

-0.0135

0

0.5231

0

$t =$

8.9336

$time =$

8.9336

$dx =$

$1.0e-05 *$

-0.0031

0

0.1214

0

$t =$

8.9435

$time =$

8.9435

$dx =$

$1.0e-05 *$

-0.0069

0

0.2676

0

$t =$

```

8.9929

time =

8.9929

dx =

1.0e-04 *

0.0086
0
-0.3354
0

t =

9.0017

time =

9.0017

dx =

1.0e-03 *

0.0036
0
-0.1384
0

t =

9.0126

time =

9.0126

dx =

1.0e-03 *

0.0052
```

```

      0
    -0.2028
      0

t =

    9.0126

time =

    9.0126

dx =

    1.0e-04 *
    -0.0034
      0
    0.1329
      0

t =

    9.0328

time =

    9.0328

dx =

    1.0e-05 *
    -0.0075
      0
    0.2902
      0

t =

    9.0428

time =

    9.0428
```

```
dx =  
  
1.0e-05 *  
  
-0.0176  
0  
0.6841  
0
```

```
t =  
  
9.0931
```

```
time =  
  
9.0931
```

```
dx =  
  
1.0e-04 *  
  
0.0232  
0  
-0.9020  
0
```

```
t =  
  
9.1020
```

```
time =  
  
9.1020
```

```
dx =  
  
1.0e-03 *  
  
0.0096  
0  
-0.3736  
0
```

```
t =  
  
9.1132
```

$time =$

9.1132

$dx =$

$1.0e-03 *$

0.0142

0

-0.5519

0

$t =$

9.1132

$time =$

9.1132

$dx =$

$1.0e-04 *$

-0.0097

0

0.3773

0

$t =$

9.1299

$time =$

9.1299

$dx =$

$1.0e-04 *$

-0.0034

0

0.1334

```

0

t =
    9.1382

time =
    9.1382

dx =
    1.0e-04 *
    -0.0049
         0
    0.1888
         0

t =
    9.1798

time =
    9.1798

dx =
    1.0e-03 *
    0.0035
         0
   -0.1376
         0

t =
    9.1872

time =
    9.1872

dx =
```

```

1.0e-03 *
0.0142
0
-0.5514
0

```

```

t =
9.1964

```

```

time =
9.1964

```

```

dx =
1.0e-03 *
0.0194
0
-0.7530
0

```

```

t =
9.1964

```

```

time =
9.1964

```

```

dx =
1.0e-04 *
-0.0085
0
0.3291
0

```

```

t =
9.2104

```

```
time =  
    9.2104  
  
dx =  
    1.0e-04 *  
    -0.0039  
        0  
    0.1505  
        0  
  
t =  
    9.2174  
  
time =  
    9.2174  
  
dx =  
    1.0e-04 *  
    -0.0044  
        0  
    0.1702  
        0  
  
t =  
    9.2523  
  
time =  
    9.2523  
  
dx =  
    1.0e-04 *  
    0.0170  
        0  
    -0.6618  
        0
```

```
t =  
  
    9.2585  
  
time =  
  
    9.2585  
  
dx =  
  
1.0e-03 *  
  
    0.0068  
    0  
   -0.2631  
    0  
  
t =  
  
    9.2663  
  
time =  
  
    9.2663  
  
dx =  
  
1.0e-03 *  
  
    0.0087  
    0  
   -0.3386  
    0  
  
t =  
  
    9.2663  
  
time =  
  
    9.2663  
  
dx =  
  
1.0e-04 *
```

```
-0.0028
      0
  0.1107
      0

t =

    9.2810

time =

    9.2810

dx =

    1.0e-05 *
-0.0122
      0
    0.4721
      0

t =

    9.2884

time =

    9.2884

dx =

    1.0e-05 *
-0.0145
      0
    0.5642
      0

t =

    9.3253

time =
```

9.3253

$dx =$

$1.0e-04 *$

0.0069

0

-0.2694

0

$t =$

9.3318

$time =$

9.3318

$dx =$

$1.0e-03 *$

0.0028

0

-0.1070

0

$t =$

9.3400

$time =$

9.3400

$dx =$

$1.0e-03 *$

0.0036

0

-0.1401

0

$t =$

```

9.3400

time =

9.3400

dx =

1.0e-05 *

-0.0126
0
0.4889
0

t =

9.3582

time =

9.3582

dx =

1.0e-05 *

-0.0037
0
0.1432
0

t =

9.3673

time =

9.3673

dx =

1.0e-05 *

-0.0063
```

```

      0
    0.2454
      0

t =

    9.4128

time =

    9.4128

dx =

    1.0e-04 *

    0.0062
      0
   -0.2395
      0

t =

    9.4209

time =

    9.4209

dx =

    1.0e-04 *

    0.0250
      0
   -0.9726
      0

t =

    9.4310

time =

    9.4310
```

```
dx =  
  
1.0e-03 *  
  
0.0035  
0  
-0.1376  
0
```

```
t =  
  
9.4310
```

```
time =  
  
9.4310
```

```
dx =  
  
1.0e-05 *  
  
-0.0190  
0  
0.7385  
0
```

```
t =  
  
9.4517
```

```
time =  
  
9.4517
```

```
dx =  
  
1.0e-05 *  
  
-0.0037  
0  
0.1446  
0
```

```
t =  
  
9.4621
```

$time =$

9.4621

$dx =$

$1.0e-05 *$

-0.0099

0

0.3849

0

$t =$

9.5138

$time =$

9.5138

$dx =$

$1.0e-04 *$

0.0141

0

-0.5496

0

$t =$

9.5230

$time =$

9.5230

$dx =$

$1.0e-03 *$

0.0059

0

-0.2291

```

0

t =

9.5345

time =

9.5345

dx =

1.0e-03 *

0.0088
0
-0.3429
0

t =

9.5345

time =

9.5345

dx =

1.0e-04 *

-0.0065
0
0.2513
0

t =

9.5531

time =

9.5531

dx =
```

```
1.0e-05 *  
-0.0179  
  0  
  0.6957  
  0
```

```
t =  
9.5625
```

```
time =  
9.5625
```

```
dx =  
1.0e-04 *  
-0.0033  
  0  
  0.1266  
  0
```

```
t =  
9.6090
```

```
time =  
9.6090
```

```
dx =  
1.0e-03 *  
  0.0034  
  0  
-0.1325  
  0
```

```
t =  
9.6173
```

```
time =  
  
    9.6173  
  
dx =  
  
    1.0e-03 *  
  
    0.0139  
      0  
    -0.5404  
      0
```

```
t =  
  
    9.6276
```

```
time =  
  
    9.6276
```

```
dx =  
  
    1.0e-03 *  
  
    0.0199  
      0  
    -0.7716  
      0
```

```
t =  
  
    9.6276
```

```
time =  
  
    9.6276
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0112  
      0  
    0.4371  
      0
```

```
t =  
  
    9.5494  
  
time =  
  
    9.5494  
  
dx =  
  
    1.0e-04 *  
  
    -0.0027  
        0  
    0.1062  
        0
```

```
t =  
  
    9.5568
```

```
time =  
  
    9.5568
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0033  
        0  
    0.1279  
        0
```

```
t =  
  
    9.5940
```

```
time =  
  
    9.5940
```

```
dx =  
  
    1.0e-04 *
```

```

    0.0161
      0
    -0.6260
      0

t =

    9.6006

time =

    9.6006

dx =

    1.0e-03 *
    0.0064
      0
    -0.2487
      0

t =

    9.6088

time =

    9.6088

dx =

    1.0e-03 *
    0.0084
      0
    -0.3264
      0

t =

    9.6088

time =
```

9.6088

$dx =$

$1.0e-04 *$

-0.0030

0

0.1150

0

$t =$

9.6237

$time =$

9.6237

$dx =$

$1.0e-05 *$

-0.0125

0

0.4863

0

$t =$

9.6311

$time =$

9.6311

$dx =$

$1.0e-05 *$

-0.0151

0

0.5855

0

$t =$

```

9.6683

time =

9.6683

dx =

1.0e-04 *

0.0074
0
-0.2865
0

t =

9.6749

time =

9.6749

dx =

1.0e-03 *

0.0029
0
-0.1138
0

t =

9.6831

time =

9.6831

dx =

1.0e-03 *

0.0038
```

```

      0
    -0.1494
      0

t =

    9.6831

time =

    9.6831

dx =

    1.0e-05 *
    -0.0136
      0
    0.5265
      0

t =

    9.7012

time =

    9.7012

dx =

    1.0e-05 *
    -0.0041
      0
    0.1575
      0

t =

    9.7102

time =

    9.7102
```

```
dx =  
  
1.0e-05 *  
  
-0.0068  
0  
0.2639  
0
```

```
t =  
  
9.7553
```

```
time =  
  
9.7553
```

```
dx =  
  
1.0e-04 *  
  
0.0065  
0  
-0.2506  
0
```

```
t =  
  
9.7633
```

```
time =  
  
9.7633
```

```
dx =  
  
1.0e-03 *  
  
0.0026  
0  
-0.1016  
0
```

```
t =  
  
9.7733
```

$time =$

9.7733

$dx =$

$1.0e-03 *$

0.0037

0

-0.1432

0

$t =$

9.7733

$time =$

9.7733

$dx =$

$1.0e-05 *$

-0.0194

0

0.7530

0

$t =$

9.7937

$time =$

9.7937

$dx =$

$1.0e-05 *$

-0.0040

0

0.1555

```

0

t =

    9.8040

time =

    9.8040

dx =

    1.0e-05 *
    -0.0100
         0
    0.3901
         0

t =

    9.8550

time =

    9.8550

dx =

    1.0e-04 *
    0.0138
         0
   -0.5369
         0

t =

    9.8641

time =

    9.8641

dx =
```

```
1.0e-03 *  
  
0.0057  
0  
-0.2231  
0
```

```
t =  
  
9.8754
```

```
time =  
  
9.8754
```

```
dx =  
  
1.0e-03 *  
  
0.0085  
0  
-0.3319  
0
```

```
t =  
  
9.8754
```

```
time =  
  
9.8754
```

```
dx =  
  
1.0e-04 *  
  
-0.0061  
0  
0.2355  
0
```

```
t =  
  
9.8940
```

```
time =  
  
    9.8940  
  
dx =  
  
    1.0e-05 *  
  
    -0.0168  
      0  
    0.6542  
      0
```

```
t =  
  
    9.9033
```

```
time =  
  
    9.9033
```

```
dx =  
  
    1.0e-04 *  
  
    -0.0031  
      0  
    0.1186  
      0
```

```
t =  
  
    9.9498
```

```
time =  
  
    9.9498
```

```
dx =  
  
    1.0e-03 *  
  
    0.0032  
      0  
    -0.1236  
      0
```

```
t =  
  
    9.9581  
  
time =  
  
    9.9581  
  
dx =  
  
    1.0e-03 *  
  
    0.0130  
        0  
    -0.5040  
        0
```

```
t =  
  
    9.9684
```

```
time =  
  
    9.9684
```

```
dx =  
  
    1.0e-03 *  
  
    0.0185  
        0  
    -0.7192  
        0
```

```
t =  
  
    9.9684
```

```
time =  
  
    9.9684
```

```
dx =  
  
    1.0e-04 *
```

```
-0.0105
      0
    0.4060
      0

t =

    9.9747

time =

    9.9747

dx =

    1.0e-04 *
    -0.0079
      0
    0.3063
      0

t =

    9.9779

time =

    9.9779

dx =

    1.0e-04 *
    -0.0073
      0
    0.2840
      0

t =

    9.9937

time =
```

9.9937

$dx =$

$1.0e-05 *$

-0.0213

0

0.8281

0

$t =$

9.9965

$time =$

9.9965

$dx =$

$1.0e-04 *$

0.0026

0

-0.1006

0

$t =$

10

$time =$

10

$dx =$

$1.0e-04 *$

0.0035

0

-0.1349

0

$t =$

```

10

time =

10

dx =

1.0e-04 *

-0.0031
    0
 0.1196
    0

```

Plot Data

```

figure('Name','Model');
plot([0,links(end,1),poses(end,1)],
[0,links(end,2),poses(end,2)], 'r-');
hold on
plot([0,links(1,1),poses(1,1)], [0,links(1,2),poses(1,2)], 'b-');
hold on

figure('Name','Task Error');
plot(T, error_task, 'r-');
hold on

figure('Name','Positions red is x');
plot(T, x, 'r-');
hold on
plot(T, y, 'b-');
hold on

figure('Name','Theta_1 Error');
plot(T, error_joints(:,1), 'r-');
hold on

figure('Name','Theta_2 Error');
plot(T, error_joints(:,2), 'r-');
hold on

figure('Name','Theta_1 Position');
plot(T, X(:,1), 'r-');
hold on

figure('Name','Theta_1 Velocity ');
plot(T, [0;diff(X(:,1))], 'r-');
hold on

```

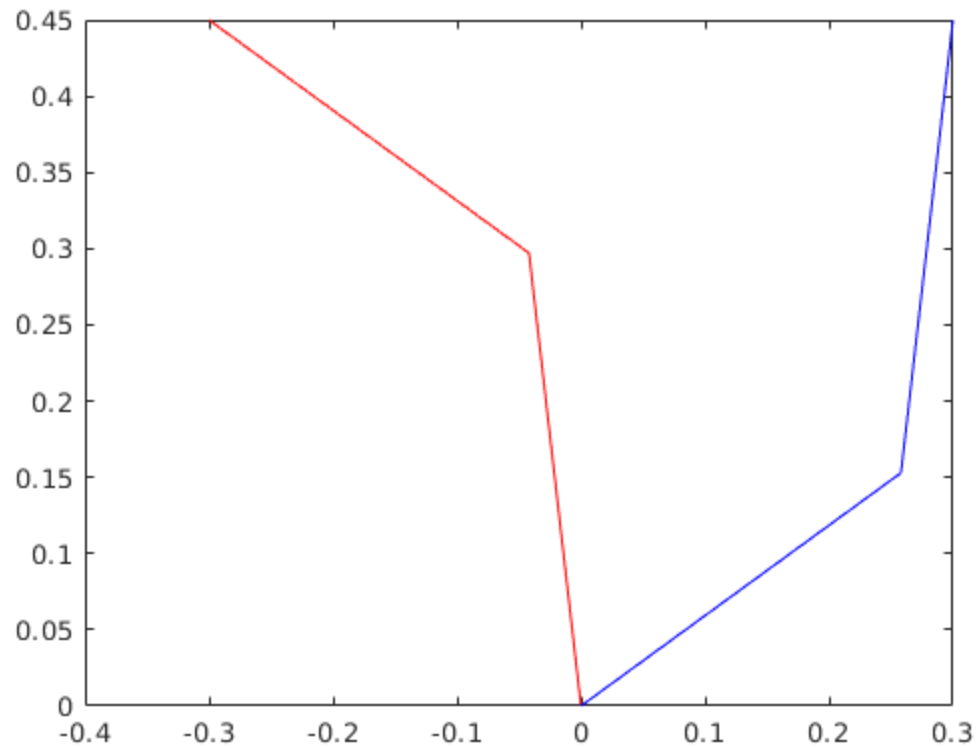
```

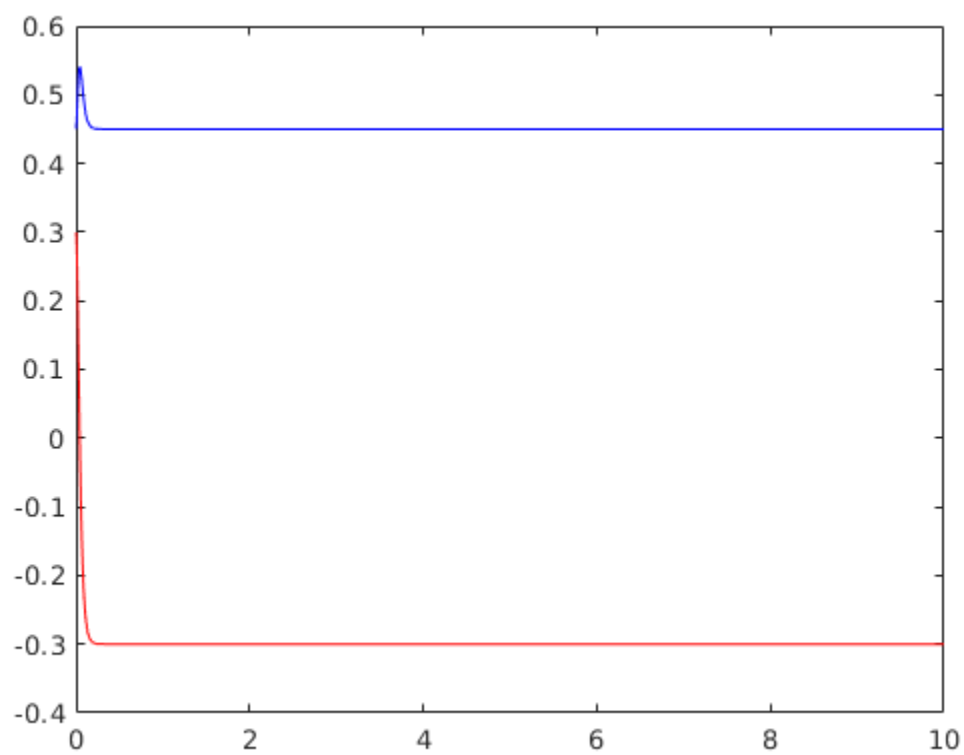
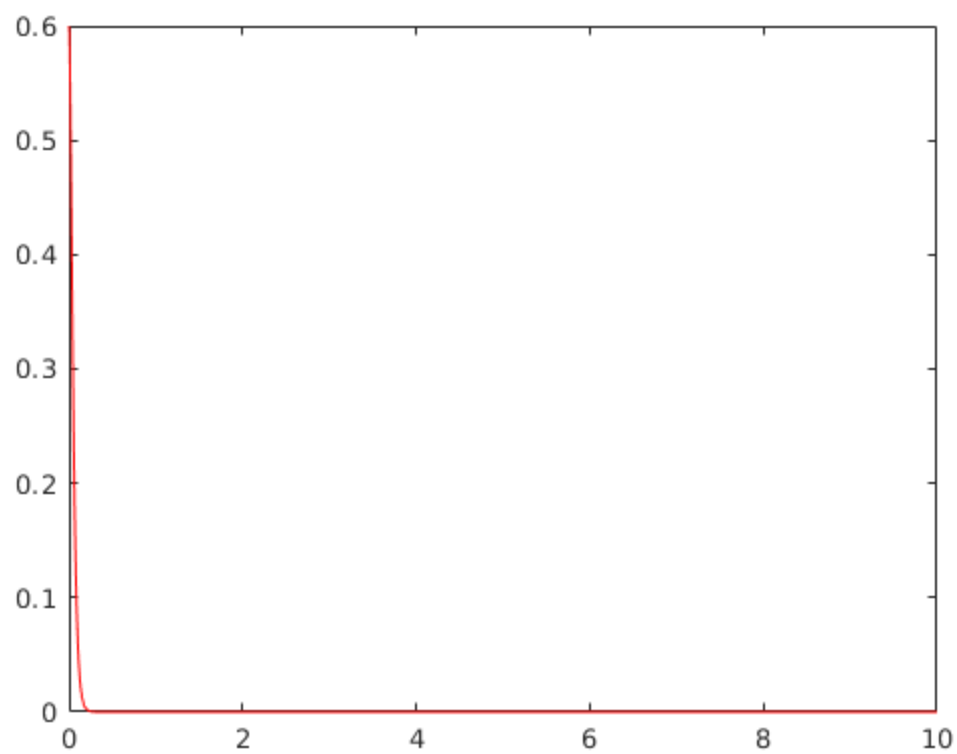
%}
figure('Name','Theta_2 under PD SetPoint Control');
plot(T, X(:,2),'r--');
hold on
figure('Name','Theta_2 Velocity ');
plot(T, [0;diff(X(:,2))],'r-');
hold on

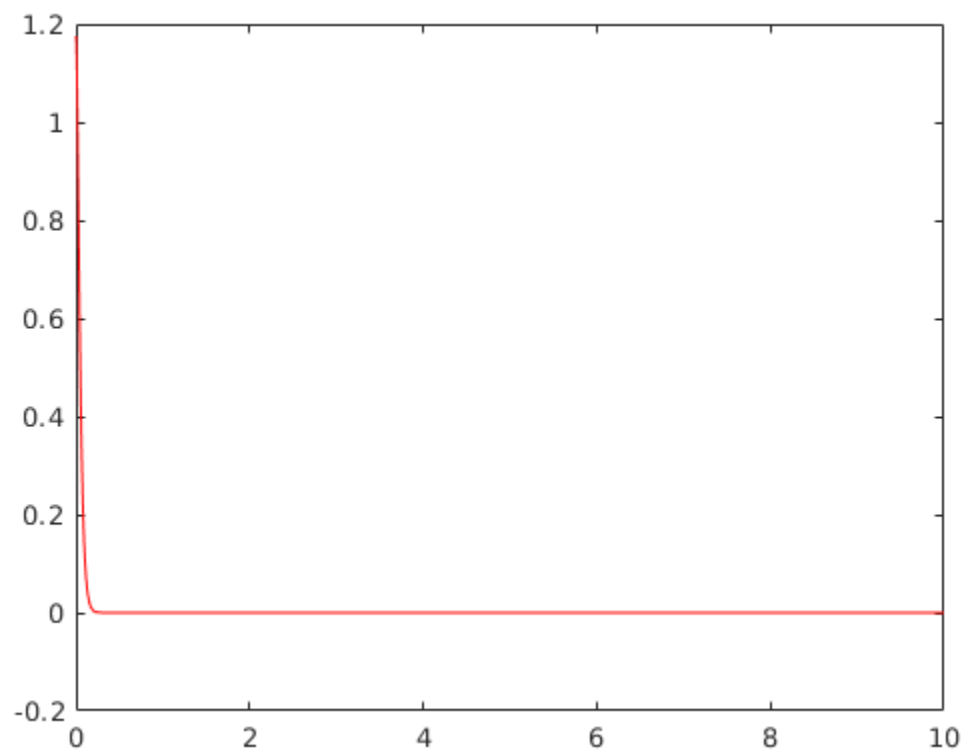
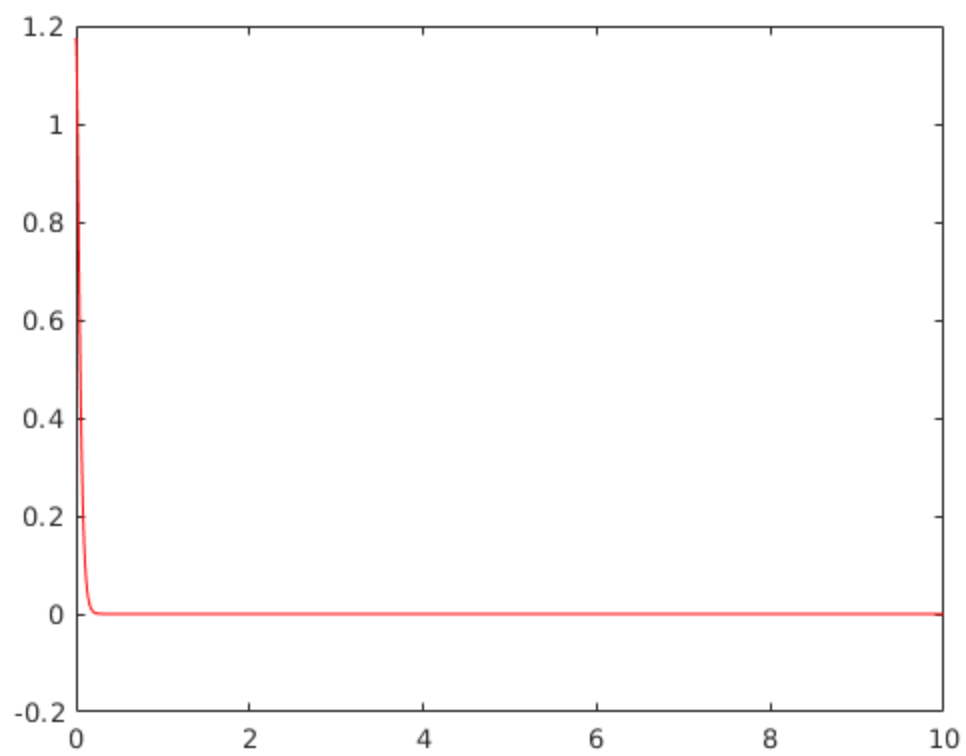
figure('Name','Input_PD control');
plot(T, torque(1,1:size(T,1)),'- ');
hold on
plot(T, torque(2,1:size(T,1)),'r--');

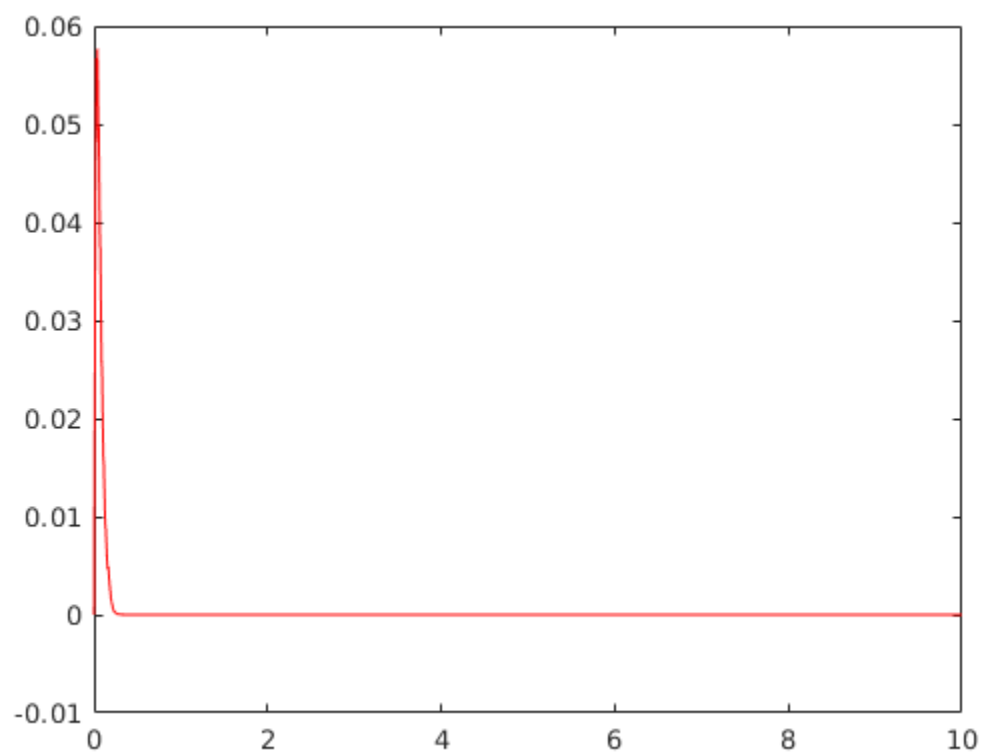
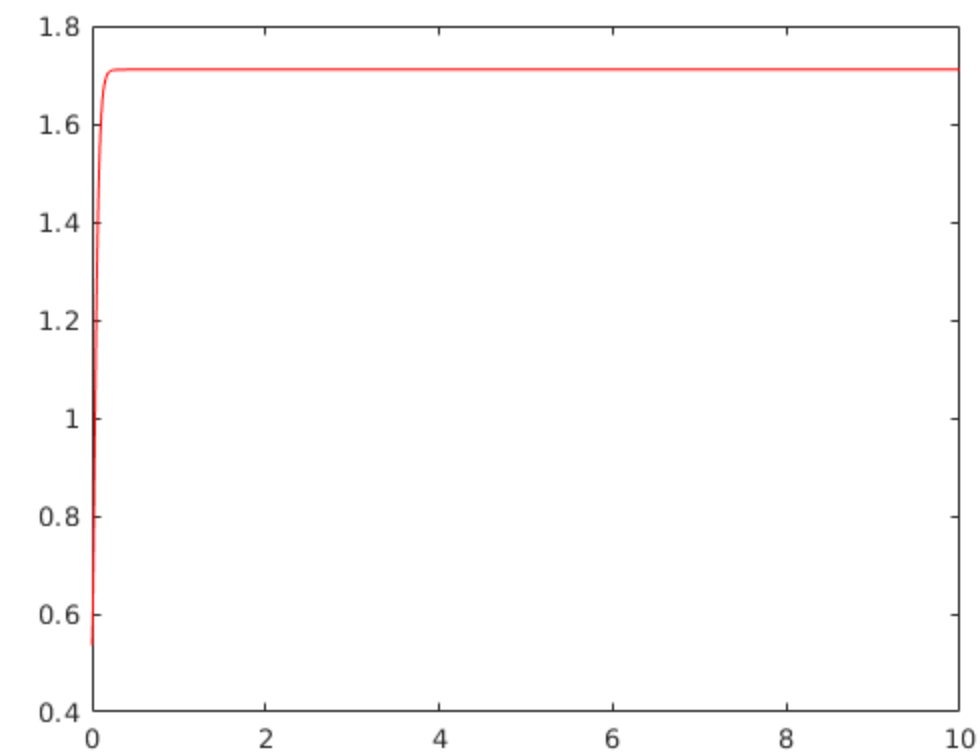
torque=[];

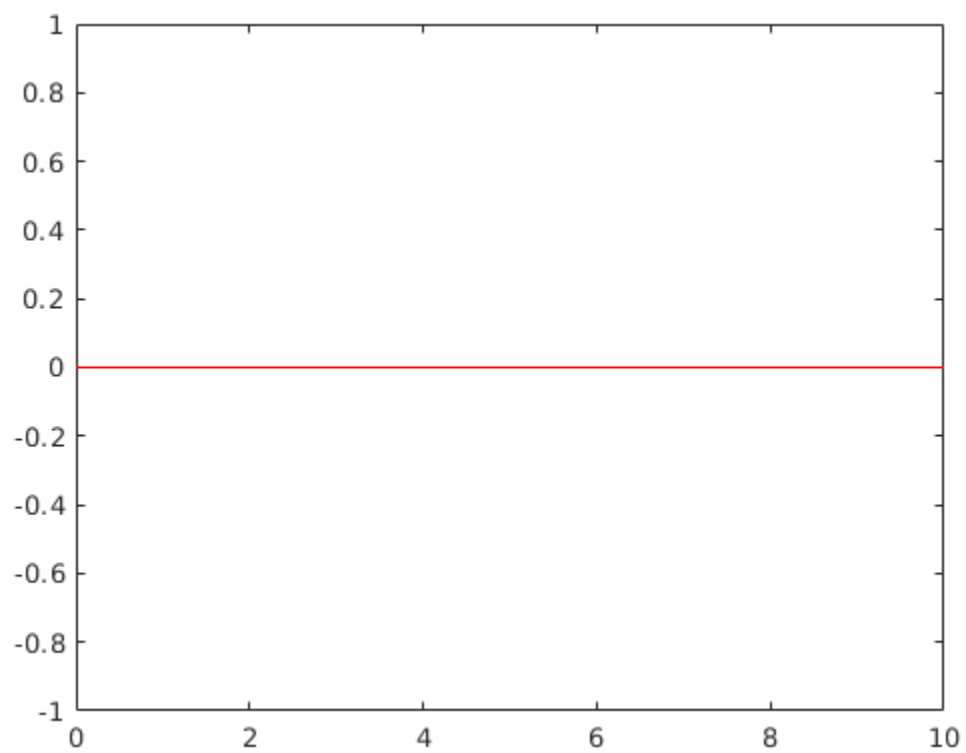
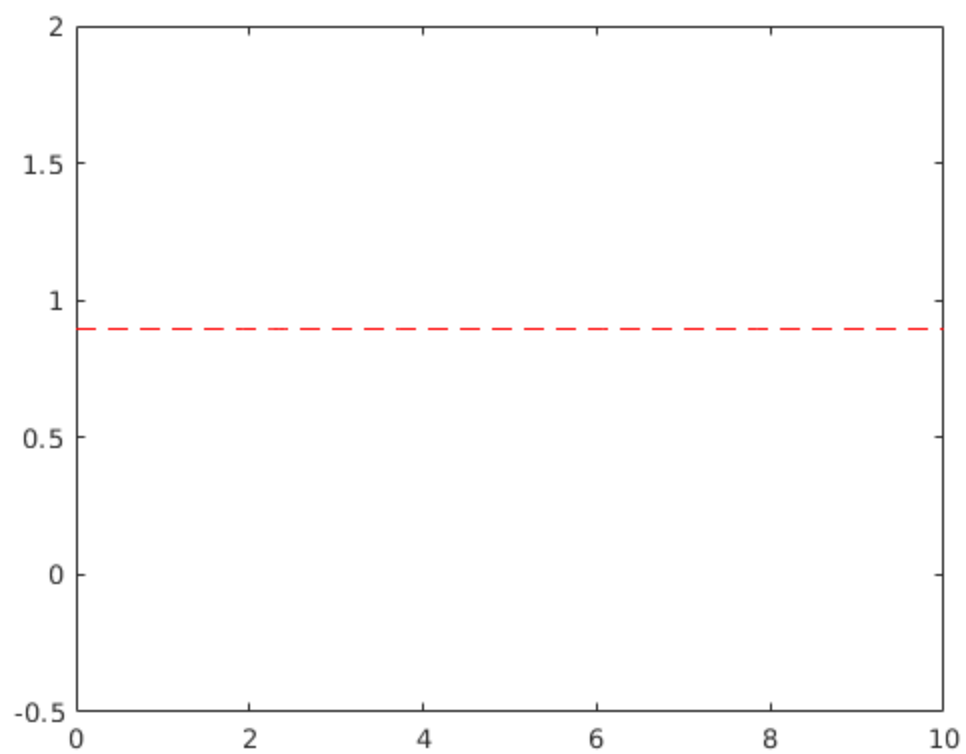
```

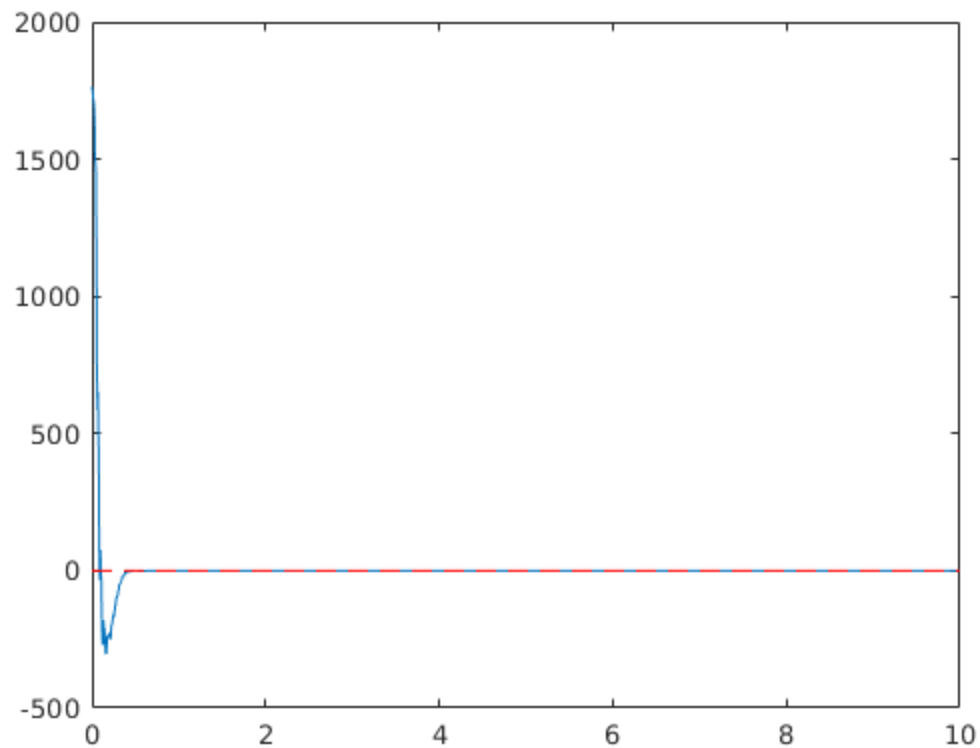












Defining Functions

```
function [q1,q2] = twoDOFIK(x,y,direction)
    q2 = direction * acos((x^2 + y^2 - l1^2 - l2^2)/(2*l1*l2));
    B = atan2((l2*sin(q2)),(l1 + l2*cos(q2)));
    Y = atan2(y,x);
    q1 = Y - direction * B;
end
function [x,y] = twoDOFFK(data,l1,l2)
    q1 = data(:,1);
    q2 = data(:,2);

    x = l1 * cos(q1) + l2*cos(q1 + q2);
    y = l1 * sin(q1) + l2*sin(q1 + q2);
end
function dx = planarArmODE(t,x)
    theta_d=[qf1;-qf2]; % Desired Set-Point Position
    dtheta_d=[0;0]; % Desired velocity (Derivative of theta_d)
    ddtheta_d=[0;0];
    theta= x(1:2,1);
    dtheta= x(3:4,1);

    t

    Mmat = subs(Mmat_symb,[q1;q2;q1d;q2d],x(:,1));
    Cmat = subs(Cmat_symb,[q1;q2;q1d;q2d],x(:,1));
```

```

        G_matrix = subs(G_matrix_symb,[q1;q2;q1d;q2d],x(:,1));

        Mmat_D = subs(Mmat_symb,[q1;q2;q1d;q2d],[theta_d;dtheta_d]);
        Cmat_D = subs(Cmat_symb,[q1;q2;q1d;q2d],[theta_d;dtheta_d]);
        G_matrix_D = subs(G_matrix_symb,[q1;q2;q1d;q2d],
[theta_d;dtheta_d]);
        tau =
        Computed_Torque(theta_d,dtheta_d,ddtheta_d,theta,dtheta,t);
%         tau = PDControl(theta_d,dtheta_d,theta,dtheta,t)...
%         + Mmat_D*ddtheta_d + Cmat_D * dtheta_d + G_matrix_D;

        torque =[torque, tau];
        dx=zeros(4,1);
        dx(1) = x(3); %dtheta1
        dx(2) = x(4); %dtheta2
        %dx(3:4) = Mmat\(tau-Cmat*x(3:4) - G_matrix);
        dx(3:4) = tau
    end

function tau =
    Computed_Torque(theta_d,dtheta_d,ddtheta_d,theta,dtheta,time)
    Kp=[1500,0;...
        0,14000];
    Kv=[77.46,0;...
        0,236.64];

    time
    e=theta_d-theta; % position error
    de = dtheta_d - dtheta; % velocity error

    tau = Kp*e + Kv*de + ddtheta_d;

end
function tau = PDControl(theta_d,dtheta_d,ddtheta_d,theta,dtheta)
    Kp=10*eye(2);
    Kv=10*eye(2);
    e=theta_d-theta; % position error
    de = dtheta_d - dtheta; % velocity error
    tau = Kp*e + Kv*de;
end

disp('Finish.');
```

Finish.

```

end
```

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