

```
1 % Ryan Dewsnap
2 % CS403 Homework 6
3 % simulation
4
5 clear all
6 close all
7 clc
8
9 max_loop = 1000;
10
11 % parameters
12 m1 = 1;
13 m2 = 1;
14 I1 = 0.05;
15 I2 = 0.05;
16 l1 = 1;
17 l2 = 0.5;
18 c1 = 0.5;
19 c2 = 0.25;
20
21 g = 9.81;
22
23 p = [c1 c2 m1 m2 l1 l2 I1 I2 g];
24
25 % initial conditions
26 th1 = 3;
27 th2 = 0;
28 dth1 = 0;
29 dth2 = 0;
30 tau1 = 0;
31 tau2 = 0;
32
33 q = [th1; th2];
34 dq = [dth1; dth2];
35 z = [q; dq];
36 u = [tau1; tau2];
37
38 dt = 0.01;
39 E = zeros(max_loop);
40 theta1 = zeros(max_loop);
41 theta2 = zeros(max_loop);
42
43 for i = 1:max_loop
44     A = A_pend(z, p);
45     b = b_pend(z, u, p);
46     ddq = inv(A)*b;
47
48     theta1(i) = z(1);
49     theta2(i) = z(2);
```

```
50     E(i) = energy_pend(z, u, p);
51
52     z = z+dt*[z(3:4) + dt*ddq; ddq];
53
54     keypoints = keypoints_pend(z, p);
55     rA = keypoints(1:3);
56     rB = keypoints(4:6);
57
58     clf
59     hold on
60
61     drawLine2D([0;0], rA);
62     drawLine2D(rA, rB);
63
64     axis equal
65     xlim([-2, 2]);
66     ylim([-2, 2]);
67
68     pause(0.01);
69 end
70
71 t = 1:max_loop;
72
73 figure
74 plot(t, E);
75 xlim([0,max_loop]);
76 xlabel(['Time']);
77 ylabel(['Energy']);
78
79 figure
80 plot(t, theta1);
81 xlim([0,max_loop]);
82 xlabel(['Time']);
83 ylabel(['Theta 1']);
84
85 figure
86 plot(t, theta2);
87 xlim([0,max_loop]);
88 xlabel(['Time']);
89 ylabel(['Theta 2']);
90
```