HW 9 Solutions

Problem 3(ghi)

```
1
2  /**
3   * Problem 3 parts (g) (h) and (i)
4   * Author: Nicolas Ventura
5   */
6
7  #include <stdio.h>
8  #include <fourbar.h>
9  #include <chplot.h>
10
11 int main(void) {
12     /* Setup */
13     CFourbar fourbar;
14     CPlot plotx, plotv, plota, plott;
15     fourbar.uscUnit(false);
16     fourbar.setLinks(5.0/100, 2.0/100, 3.0/100, 4.5/100, deg2rad
        (15.0));
17     fourbar.setCouplerPoint(2.5/100, deg2rad(30.0));
18     fourbar.setNumPoints(100);
19     /* Part (g) */
20     fourbar.setAngularVel(15.0);
21     fourbar.plotAngularPoss(&plotx, 1);
22     fourbar.plotAngularVels(&plotv, 1);
23     fourbar.plotAngularAccels(&plota, 1);
24     /* Part (h) */
25     array double x[9],
26         theta_1[1:4], theta_2[1:4],
27         omega_1[1:4], omega_2[1:4],
28         alpha_1[1:4], alpha_2[1:4];
29     theta_1[1] = deg2rad(15.0);
30     theta_1[2] = deg2rad(45.0);
31     theta_2[1] = deg2rad(15.0);
32     theta_2[2] = deg2rad(45.0);
33     omega_1[2] = 15.0;
34     omega_2[2] = 15.0;
35     fourbar.setMass(0.8, 2.4, 1.4);
36     fourbar.setInertia(0.012, 0.119, 0.038);
37     fourbar.setGravityCenter(1.25/100, 2.75/100, 2.50/100,
38         deg2rad(30.0), deg2rad(15.0), deg2rad(30.0));
39     fourbar.angularPos(theta_1, theta_2, FOURBAR_LINK2);
40     fourbar.angularVel(theta_1, omega_1, FOURBAR_LINK2);
41     fourbar.angularVel(theta_2, omega_2, FOURBAR_LINK2);
42     fourbar.angularAccel(theta_1, omega_1, alpha_1, FOURBAR_LINK2);
43     fourbar.angularAccel(theta_2, omega_2, alpha_2, FOURBAR_LINK2);
44     fourbar.forceTorque(theta_1, omega_1, alpha_1, 30.0, x);
45     printf("Solution 1:\n%9.3lf\n", x);
46     fourbar.forceTorque(theta_2, omega_2, alpha_2, 30.0, x);
47     printf("Solution 2:\n%9.3lf\n", x);
48     /* Part (i) */
49     fourbar.plotForceTorques(&plott, 1, 30.0);
50     return 0;
51 }
```

```
1  Solution 1:
2    322.775    358.705    323.357    353.030    333.624    349.362
        -334.308   -343.428
3      0.445
4
5  Solution 2:
6  -1075.652   -147.046  -1075.069   -152.721  -1084.654   -173.079
        1089.221    186.528
7     13.069
```
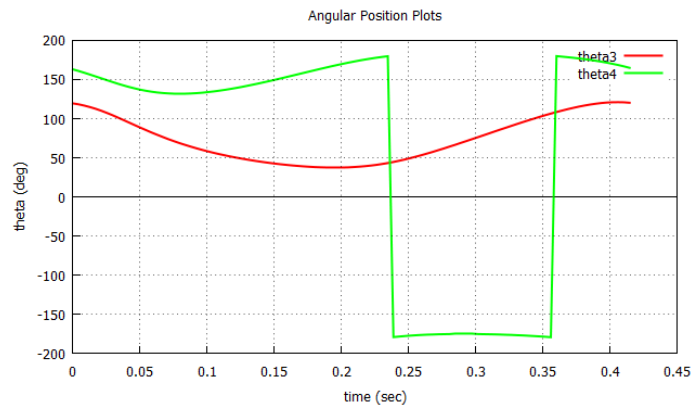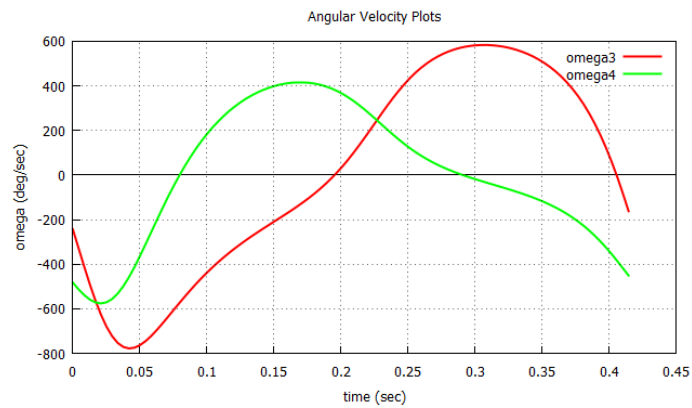

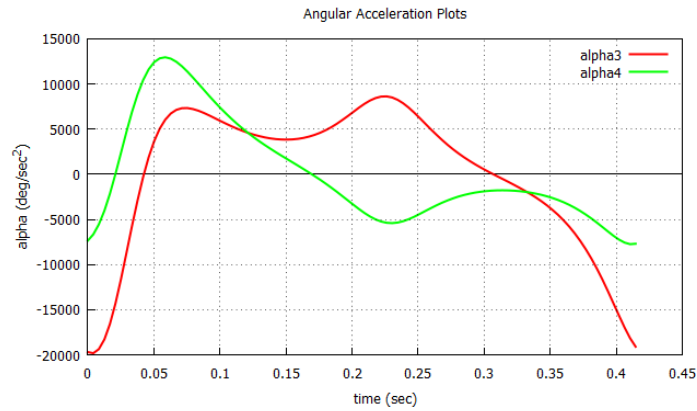*Image 1: Figure 1*

Image 2: Figure 2

Image 3: Figure 3
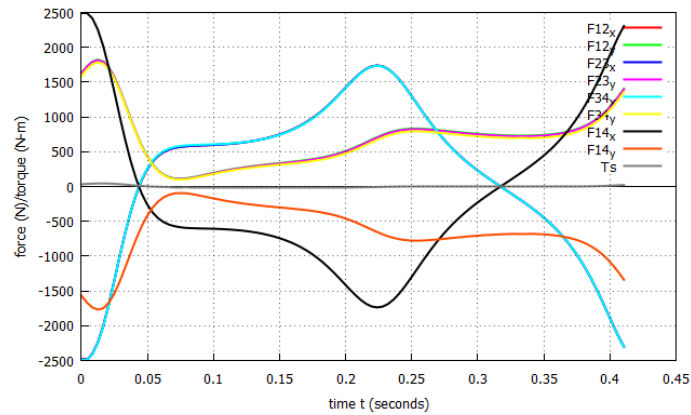

Image 4: Figure 4

Problem 4

```
1
2   /**
3    * File: prob4.ch
4    * Author: Nicolas Ventura
5    * Synthesize a 4 bar mechanism.
6    */
7
8   #include <fourbar.h>
9
10  int main(void) {
11      double r [1:4];
12      double psi [1:3], phi [1:3];
13      double theta [1:4], theta3 [1:3];
14      CFourbar fourbar;
15      /* specify input/output relation for a four-bar linkage */
16      r[1] = 1;
17      psi[1] = 60.0 * M_PI / 180;
```

```
18    psi[2] = 90.0 * M_PI / 180;
19    psi[3] = 120.0 * M_PI / 180;
20    phi[1] = 100.0 * M_PI / 180;
21    phi[2] = 150.0 * M_PI / 180;
22    phi[3] = 200.0 * M_PI / 180;
23    fourbar.synthesis(r, phi, psi);
24    /* display link lengths */
25    printf("r2 = %.3f, r3 = %.3f, r4 = %.3f\n", r[2], r[3], r[4]);
26    /* obtain theta3 in three positions and display these positions
      */
27    theta[1] = 0;
28    fourbar.setLinks(r[1], r[2], r[3], r[4], theta[1]);
29    // phi1, psi1
30    theta[2] = phi[1];
31    theta[4] = psi[1];
32    fourbar.getAngle(theta, FOURBAR_LINK3);
33    theta3[1] = theta[3];
34    // phi2, psi2
35    theta[2] = phi[2];
36    theta[4] = psi[2];
37    fourbar.getAngle(theta, FOURBAR_LINK3);
38    theta3[2] = theta[3];
39    // psi3, psi3
40    theta[2] = phi[3];
41    theta[4] = psi[3];
42    fourbar.getAngle(theta, FOURBAR_LINK3);
43    theta3[3] = theta[3];
44    fourbar.displayPositions(phi, theta3, psi);
45    return 0;
46  }
```
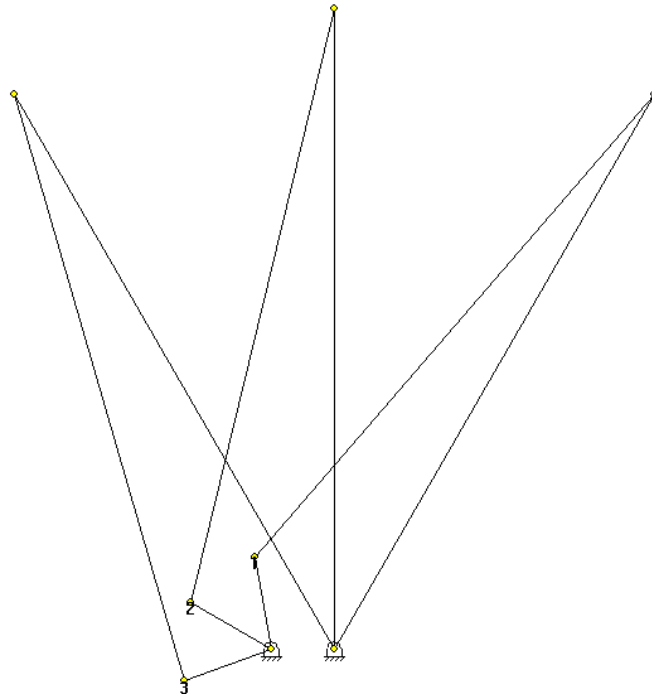
Image 5: r2 = 1.499, r3 = 9.783, r4 = 10.259