Appendix A
Test Curve Definitions and Results

In this appendix we provide the data used to produce the figures in Chapter 4. These data are presented in the format read by the curve optimization program. We also provide the coefficients of the quintic Hermite polynomials used to approximate the MEC and MVC computed for these constraint sets. The coefficients are provided for those examples appearing in Table 1 and selected others. Each quintic segment is defined by six rows of x and y coefficients, z coefficients are included for space curves. The coefficients in each set of six are arranged as follows:

x	y	z
$\vec{C}_x(0)$	$\vec{C}_y(0)$	$\vec{C}_z(0)$
$\vec{C}'_x(0)$	$\vec{C}'_y(0)$	$\vec{C}'_z(0)$
$\vec{C}''_x(0)$	$\vec{C}''_y(0)$	$\vec{C}''_z(0)$
$\vec{C}''_x(1)$	$\vec{C}''_y(1)$	$\vec{C}''_z(1)$
$\vec{C}'_x(1)$	$\vec{C}'_y(1)$	$\vec{C}'_z(1)$
$\vec{C}_x(1)$	$\vec{C}_y(1)$	$\vec{C}_z(1)$

Figure 4.2. The Wicket.

```
(G2Joint    a          (-1,0,0)
            (Fixed     Tangent     (0,1,0)))
(G2Joint    b          (1,0,0)
            (Fixed     Tangent     (0,-1,0)))
(G2Curve     test    Open        (a,b))
```

MVC Wicket

x	y
-1.000000000000000000,	0.000000000000000000
0.000000000000000000,	3.339604570886604200
11.152885331851587000,	-1.397023282660818700
-11.152885239807613000,	-1.397023345756839500
0.000000000000000000,	-3.339604546536601800
1.000000000000000000,	0.000000000000000000

MEC Wicket

x	y
-1.000000000000000000,	0.000000000000000000
0.000000000000000000,	4.692084720170503200
-0.135640024937254740,	5.319109370220547600
0.135640025547803110,	5.319109370749801600
0.000000000000000000,	-4.692084720375821600
1.000000000000000000,	0.000000000000000000

Figure 4.9. Multiple MVC Curves from One Specification.①

```
(G2Joint   a      (-1.5,0,0)    (Initial    Tangent   (1,0.1,0)))
(G2Joint   b      (-0.5,0.5,0))
(G2Joint   mid    (0,1,0)       (Initial    Tangent   (-1,0,0))
           (Fixed Curvature     (0,-10,0)))
(G2Joint   c      (0.5,0.5,0))
(G2Joint   d      (1.5,0,0)     (Initial    Tangent   (1,-0.1,0)))
(G2Curve   test   Open   (a,b,mid,c,d))
```

Figure 4.9. Multiple MVC Curves from One Specification.②

```
(G2Joint   a      (-1.5,0,0)    (Initial    Tangent   (1,0.1,0)))
(G2Joint   b      (-0.5,0.5,0))
(G2Joint   mid    (0,1,0)       (Initial    Tangent   (1,0,0))
           (Fixed Curvature     (0,-10,0)))
(G2Joint   c      (0.5,0.5,0))
(G2Joint   d      (1.5,0,0)     (Initial    Tangent   (1,-0.1,0)))
(G2Curve   test   Open   (a,b,mid,c,d))
```

Figure 4.10. Blending the Corners of a Box.②

```
(G1Joint   pt0   (2,1,0)    (Fixed   Tangent   (0,1,0)))
(G1Joint   pt1   (1,2,0)    (Fixed   Tangent   (-1,0,0)))
(G1Joint   pt2   (-1,2,0)   (Fixed   Tangent   (-1,0,0)))
(G1Joint   pt3   (-2,1,0)   (Fixed   Tangent   (0,-1,0)))
(G1Joint   pt4   (-2,-1,0)  (Fixed   Tangent   (0,-1,0)))
(G1Joint   pt5   (-1,-2,0)  (Fixed   Tangent   (1,0,0)))
```

(G1Joint pt6 (1,-2,0) (Fixed Tangent (1,0,0)))
(G1Joint pt7 (2,-1,0) (Fixed Tangent (0,1,0)))
(G2Curve test Closed (pt0,pt1,pt2,pt3,pt4,pt5,pt6,pt7))

MVC G^1 Box

x	y
2.000000000000000000	1.000000000000000000
0.000000000000000000	1.572188061452545000
-2.471771120970351900	0.004606320531753661
0.004606320531753814	-2.471771120970369200
-1.572188061452548300	0.000000000000000000
1.000000000000000000	2.000000000000000000
1.000000000000000000	2.000000000000000000
-2.007564017841089400	0.000000000000000000
0.002091398719665465	0.000037352839841653
-0.002091398719668384	0.000037352839852335
-2.007564017841089400	0.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.572188061452545000	0.000000000000000000
-0.004606320531753661	-2.471771120970351900
2.471771120970369200	0.004606320531753814
0.000000000000000000	-1.572188061452548300
-2.000000000000000000	1.000000000000000000
-2.000000000000000000	1.000000000000000000
0.000000000000000000	-2.007564017841089400
-0.000037352839841653	0.002091398719665465
-0.000037352839852335	-0.002091398719668384
0.000000000000000000	-2.007564017841089400
-2.000000000000000000	-1.000000000000000000
-2.000000000000000000	-1.000000000000000000
0.000000000000000000	-1.572188061452545000
2.471771120970351900	-0.004606320531753661
-0.004606320531753814	2.471771120970369200
1.572188061452548300	0.000000000000000000
-1.000000000000000000	-2.000000000000000000
-1.000000000000000000	-2.000000000000000000
2.007564017841089400	0.000000000000000000
-0.002091398719665465	-0.000037352839841653
0.002091398719668384	-0.000037352839852335
2.007564017841089400	0.000000000000000000
1.000000000000000000	-2.000000000000000000
1.000000000000000000	-2.000000000000000000
1.572188061452545000	0.000000000000000000
0.004606320531753661	2.471771120970351900

x	y
-2.471771120970369200	-0.004606320531753814
0.000000000000000000	1.572188061452548300
2.000000000000000000	-1.000000000000000000
2.000000000000000000	-1.000000000000000000
0.000000000000000000	2.007564017841089400
0.000037352839841602	-0.002091398719665490
0.000037352839852229	0.002091398719668344
0.000000000000000000	2.007564017841089000
2.000000000000000000	1.000000000000000000

MEC G^1 Box

x	y
2.000000000000000000	1.000000000000000000
0.000000000000000000	1.568487761472243400
-2.170881086348618100	0.170012542253929010
0.170012542253353100	-2.170881086347895100
-1.568487761472023800	0.000000000000000000
1.000000000000000000	2.000000000000000000
1.000000000000000000	2.000000000000000000
-0.165956461600846370	0.000000000000000000
-0.005231878959692125	0.000699498602219908
0.005231878959692118	0.000699498602220033
-0.165956461600842630	0.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.568487761472268500	0.000000000000000000
-0.170012542253951490	-2.170881086348706000
2.170881086347749500	0.170012542253325130
0.000000000000000000	-1.568487761471974800
-2.000000000000000000	1.000000000000000000
-2.000000000000000000	1.000000000000000000
0.000000000000000000	-0.165956461600846370
-0.000699498602219908	-0.005231878959692125
-0.000699498602220033	0.005231878959692118
0.000000000000000000	-0.165956461600842630
-2.000000000000000000	-1.000000000000000000
-2.000000000000000000	-1.000000000000000000
0.000000000000000000	-1.568487761472268500
2.170881086348706000	-0.170012542253951490
-0.170012542253325130	2.170881086347749500
1.568487761471974800	0.000000000000000000
-1.000000000000000000	-2.000000000000000000
-1.000000000000000000	-2.000000000000000000
0.165956461600846370	0.000000000000000000

x	y
0.005231878959692125	-0.000699498602219908
-0.005231878959692118	-0.000699498602220033
0.165956461600842630	0.000000000000000000
1.000000000000000000	-2.000000000000000000
1.000000000000000000	-2.000000000000000000
1.568487761472268500	0.000000000000000000
0.170012542253951490	2.170881086348706000
-2.170881086347749500	-0.170012542253325130
0.000000000000000000	1.568487761471974800
2.000000000000000000	-1.000000000000000000
2.000000000000000000	-1.000000000000000000
0.000000000000000000	0.165956461600846510
0.000699498602219915	0.005231878959692129
0.000699498602220040	-0.005231878959692123
0.000000000000000000	0.165956461600842790
2.000000000000000000	1.000000000000000000

Figure 4.10. Blending the Corners of a Box.①

```
(G2Joint    pt0     (2,1,0)
            (Fixed  Tangent   (0,1,0))   (Fixed  Curvature  (0,0,0)))
(G2Joint    pt1     (1,2,0)
            (Fixed  Tangent   (-1,0,0))  (Fixed  Curvature  (0,0,0)))
(G2Joint    pt2     (-1,2,0)
            (Fixed  Tangent   (-1,0,0))  (Fixed  Curvature  (0,0,0)))
(G2Joint    pt3     (-2,1,0)
            (Fixed  Tangent   (0,-1,0))  (Fixed  Curvature  (0,0,0)))
(G2Joint    pt4     (-2,-1,0)
            (Fixed  Tangent   (0,-1,0))  (Fixed  Curvature  (0,0,0)))
(G2Joint    pt5     (-1,-2,0)
            (Fixed  Tangent   (1,0,0))   (Fixed  Curvature  (0,0,0)))
(G2Joint    pt6     (1,-2,0)
            (Fixed  Tangent   (1,0,0))   (Fixed  Curvature  (0,0,0)))
(G2Joint    pt7     (2,-1,0)
            (Fixed  Tangent   (0,1,0))   (Fixed  Curvature  (0,0,0)))
(G2Curve    test    Closed    (pt0,pt1,pt2,pt3,pt4,pt5,pt6,pt7))
```

MVC G^2 Box

x	y
2.000000000000000000	1.000000000000000000
0.000000000000000000	1.818569178683748100
0.000000000000000000	-0.846045050683249090
-0.846045050683599360	0.000000000000000000
-1.818569178684742900	0.000000000000000000
1.000000000000000000	2.000000000000000000

x	y
1.000000000000000000	2.000000000000000000
-2.000000000000000400	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
-2.000000000000000400	0.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.818569178683748100	0.000000000000000000
0.846045050683249090	0.000000000000000000
0.000000000000000000	-0.846045050683599360
0.000000000000000000	-1.818569178684742900
-2.000000000000000000	1.000000000000000000
-2.000000000000000000	1.000000000000000000
0.000000000000000000	-2.000000000000000400
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	-2.000000000000000400
-2.000000000000000000	-1.000000000000000000
-2.000000000000000000	-1.000000000000000000
0.000000000000000000	-1.818569178683748100
0.000000000000000000	0.846045050683249090
0.846045050683599360	0.000000000000000000
1.818569178684742900	0.000000000000000000
-1.000000000000000000	-2.000000000000000000
-1.000000000000000000	-2.000000000000000000
2.000000000000000400	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
2.000000000000000400	0.000000000000000000
1.000000000000000000	-2.000000000000000000
1.000000000000000000	-2.000000000000000000
1.818569178683748100	0.000000000000000000
-0.846045050683249090	0.000000000000000000
0.000000000000000000	0.846045050683599360
0.000000000000000000	1.818569178684742900
2.000000000000000000	-1.000000000000000000
2.000000000000000000	-1.000000000000000000
0.000000000000000000	2.000000000000000400
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	2.000000000000000400
2.000000000000000000	1.000000000000000000

MEC G^2 Box

x	y
2.000000000000000000	1.000000000000000000
0.000000000000000000	0.481346323583097370
0.000000000000000000	8.949839802519163000
8.949839802248662900	0.000000000000000000
-0.481346323568559110	0.000000000000000000
1.000000000000000000	2.000000000000000000
1.000000000000000000	2.000000000000000000
-2.000000000000000400	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
-2.000000000000000400	0.000000000000000000
-1.000000000000000000	2.000000000000000000
-1.000000000000000000	2.000000000000000000
-0.481346323583097370	0.000000000000000000
-8.949839802519163000	0.000000000000000000
0.000000000000000000	8.949839802248662900
0.000000000000000000	-0.481346323568559110
-2.000000000000000000	1.000000000000000000
-2.000000000000000000	1.000000000000000000
0.000000000000000000	-2.000000000000000400
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	-2.000000000000000400
-2.000000000000000000	-1.000000000000000000
-2.000000000000000000	-1.000000000000000000
0.000000000000000000	-0.481346323583097370
0.000000000000000000	-8.949839802519163000
-8.949839802248662900	0.000000000000000000
0.481346323568559110	0.000000000000000000
-1.000000000000000000	-2.000000000000000000
-1.000000000000000000	-2.000000000000000000
2.000000000000000400	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
2.000000000000000400	0.000000000000000000
1.000000000000000000	-2.000000000000000000
1.000000000000000000	-2.000000000000000000
0.481346323583097370	0.000000000000000000
8.949839802519163000	0.000000000000000000
0.000000000000000000	-8.949839802248662900
0.000000000000000000	0.481346323568559110
2.000000000000000000	-1.000000000000000000

x	y
2.000000000000000000	-1.000000000000000000
0.000000000000000000	2.000000000000000400
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
0.000000000000000000	2.000000000000000400
2.000000000000000000	1.000000000000000000

Figure 4.11. MVC vs. MEC and Natural Splines.

```
(G2Joint    a    (0,0,0))
(G2Joint    b    (1,1.9,0))
(G2Joint    c    (2,2.7,0))
(G2Joint    d    (3,2.6,0))
(G2Joint    e    (4,1.6,0))
(G2Joint    f    (5,0.89,0))
(G2Joint    g    (6,1.2,0))
(G2Curve    test    Open        (a,b,c,d,e,f,g))
```

MVC Woodford

x	y
0.000000000000000000	0.000000000000000000
0.895706961882983820	1.957602735457642000
0.138116531243261090	-0.007460993038492146
0.950336864105681740	-0.723238623568194680
1.226992709070398700	1.731998021036268700
1.000000000000000000	1.899999999999999900
1.000000000000000000	1.899999999999999900
0.736631406425843020	1.039813952219272600
0.341076876087715750	-0.262720381219853420
0.374159349449745160	-1.234293454103546400
1.276352407316269500	0.379079327591151930
2.000000000000000000	2.700000000000000200
2.000000000000000000	2.700000000000000200
0.987026269314594810	0.293148861036986170
0.223941997150225750	-0.738077511555863320
-0.313252904433228950	-0.640273750582883380
0.919995843472537820	-0.475735465574735170
3.000000000000000000	2.600000000000000100
3.000000000000000000	2.600000000000000100
1.257453686820322500	-0.650236975941283490
-0.583492801176973220	-1.197013778096099200
0.243047472123983250	0.246235997524879740
0.894274438387285820	-1.103115925695012500
4.000000000000000000	1.600000000000000100
4.000000000000000000	1.600000000000000100

x	y
0.788065060272710170	-0.972103284130933500
0.188594695290718790	0.191404747823292250
0.206132714814211420	1.296965844295417900
1.219064320176212600	-0.247386799026987620
5.000000000000000000	0.890000000000000010
5.000000000000000000	0.890000000000000010
1.041194033679268700	-0.211291278806912870
0.143765661390689000	0.947443416051865330
-0.801532699461220850	1.085239013974033100
0.800568752284721020	0.859094412108452280
6.000000000000000000	1.200000000000000000

MEC Woodford

x	y
0.000000000000000000	0.000000000000000000
0.850166319401722710	1.958481078380348600
0.001824248225836333	0.007791546189537588
0.733134601003124660	-0.616940467375432510
1.270507025303729800	1.726903101643841200
1.000000000000000000	1.899999999999999900
1.000000000000000000	1.899999999999999900
0.762887395443757170	1.036934533346533800
0.264851931674635330	-0.221732405115490060
0.371842025691673290	-1.267109569086311900
1.259917399656275800	0.376248155646289660
2.000000000000000000	2.700000000000000200
2.000000000000000000	2.700000000000000200
0.996692543012572480	0.297641520910178090
0.235271846591626870	-0.792194148853525460
-0.313579617589919590	-0.650848712213846550
0.910485272947530680	-0.469980947560508680
3.000000000000000000	2.600000000000000100
3.000000000000000000	2.600000000000000100
1.267105467144682200	-0.654063767753085950
-0.602519409932451340	-1.263034154317588900
0.115138824492793890	0.152815145156221770
0.858519716078747890	-1.094676325330322200
4.000000000000000000	1.600000000000000100
4.000000000000000000	1.600000000000000100
0.770000814965735910	-0.981808159838148400
0.091743352114028190	0.124044740659081190
0.241029377584454250	1.798817524749730000
1.264770554097381000	-0.135794155227056600
5.000000000000000000	0.890000000000000010

x	y
5.000000000000000000	0.890000000000000010
1.062566848745276600	-0.114084224312618550
0.182788334493450530	1.268266975320603300
-0.002492900176544379	0.004387465129715400
0.905306984108416700	0.501211498512781570
6.000000000000000000	1.200000000000000000

Figure 4.13. Planar S-shaped Curves, MVC vs. SI-MVC

```
(G2Joint    a    1    Fixed    (-2,0,0)    (Fixed    Tangent    (-1,0,0)))
(G2Joint    b    2    Fixed    (0,0,0)     (Initial  Tangent    (1,-1,0)))
(G2Joint    c    3    Fixed    (2,0,0)     (Fixed    Tangent    (-1,0,0)))

(G2Curve    test    Open    (a,b,c))
```

MVC Planar S

x	y
-2.000000000000000000	0.000000000000000000
0.000000000000000000	2.860963429830545700
10.598732289532171000	-1.761417091639582200
1.218185541957548900	-1.528097160495165200
1.987573949878479500	-2.493167901229647900
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
1.987560128941692600	-2.493150564558494600
-1.218206227525659500	1.528057683842199300
-10.598808209987586000	1.761394932761270800
0.000000000000000000	2.860970283458000200
2.000000000000000000	0.000000000000000000

SI-MVC Planar S

-2.000000000000000000	0.000000000000000000
0.000000000000000000	2.555486051505411600
9.418447741144513300	-1.262060633140546200
1.296403845320799300	-1.386947688280506300
2.220610538787489500	-2.373177371829916300
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
2.220388526532516900	-2.372940106244363400
-1.297995306784533800	1.385699702347881200
-9.418483725329133800	1.261973056289178200
0.000000000000000000	2.555582054915814800
2.000000000000000000	0.000000000000000000

Figure 4.14. A Curve from Antipodal Tangent Constraints

```
(G2Joint    a    1    Fixed    (-2,0,0)    (Fixed      Tangent    (-1,0,0)))
(G2Joint    b    2    Fixed    (0,0,0)     (Initial    Tangent    (1,-1,0)))
(G2Joint    c    3    Fixed    (2,0,0)     (Fixed      Tangent    (-1,0,0)))

(G2Curve    test    Open    (a,b,c))
```

SI-MVC from Antipodal Tangent Constraints

x	y
-2.000000000000000000	0.000000000000000000
-5.656778106812373300	0.000000000000000000
10.348410909356211000	39.487317404691396000
-1.483451659599880300	3.414200869535436700
2.846789650620191300	-6.552005467716160300
0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000
2.846789931535775400	-6.552006114255128500
1.483407565897053800	-3.414149747511139800
-10.348447590104763000	-39.48736276839746000
-5.656780185756640700	0.000000000000000000
2.000000000000000000	0.000000000000000000

Figure 4.15. An SI-MVC Figure-8.

```
(G2Joint    a    Initial    (-2,0,0)    (Initial    Tangent    (0,1,0)))
(G2Joint    b    Initial    (0,0,0)     (Initial    Tangent    (1,-1,0)))
(G2Joint    c    Initial    (2,0,0)     (Initial    Tangent    (0,1,0)))
(G2Joint    d    Initial    (0,0,0)     (Initial    Tangent    (-1,-1,0)))
(G2Curve    test    Closed    (a,b,c,d))
```

SI-MVC Figure-8

x	y
-2.059438815174891700	0.000003105153437 06
0.000000026487255110	2.679774226217526600
10.054345895709034000	-1.528680488254063700
1.365515068654025400	-1.459323900376956500
2.263550943524616600	-2.419144944425363900
0.000003095254827856	-0.000002264150156569
0.000003095254827856	-0.000002264150156569
2.263544637954198800	-2.419138205416975200
-1.365372440630191000	1.459281810743707600
-10.054228280691872000	1.528595066277622600
-0.000010314671962915	2.679757749513795900
2.059439003643854300	0.000004584664002064

x	y
2.059439003643854300	0.000004584664002064
-0.000010314622031358	2.679744777266389400
-10.054119171968471000	-1.528589662848433000
-1.365505776314093600	-1.459313589897367700
-2.263561937541239500	-2.419161445125951100
-0.000003283723838783	-0.000002631029189197
-0.000003283723838783	-0.000002631029189197
-2.263556322734365800	-2.419155444351647000
1.365408607705594500	1.459326575204787500
10.054024148001007000	1.528505328424123500
0.000000026486831259	2.679731344308613500
-2.059438815174891700	0.000003105153437 06

Figure 4.16. A simple space curve for comparing MVC with MEC.

```
(G2Joint a (-1,1,0) (Fixed Tangent (0,0,1)))
(G2Joint b (0,0,1) (Fixed Tangent (1,0,0)))
(G2Joint c (1,1,0) (Fixed Tangent (0,0,-1)))
(G2Curve test Open (a,b,c))
```

MVC Space Curve

x	y	z
-1.000000000000000000	1.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	1.078867484913692800
0.354420491775258860	-1.435904154680027700	-0.297943080553370930
0.673958122061576790	-0.010428915469809950	-0.666215116998288170
0.459185483511367950	-0.759850105427875900	0.461589706755405390
-0.801205879876136890	0.501364567946027910	0.799553000101731360
-0.801205879876136890	0.501364567946027910	0.799553000101731360
0.455478093420548400	-0.753715197307894380	0.457862905350963910
0.669909429724079410	-0.021497524066445631	-0.648674930045294640
0.312988277961696540	1.468429588826430700	-0.362450059663945610
1.091008392794767600	0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	1.000000000000000000
0.000000000000000000	0.000000000000000000	1.000000000000000000
1.091008435233340000	0.000000000000000000	0.000000000000000000
-0.312988284304521470	1.468429703065802400	-0.362450087861461820
-0.669909515856446310	-0.021497380000049405	-0.648674715378938170
0.455478278305560980	0.753714766389898870	-0.457863271569038110
0.801205809480143420	0.501364690351200460	0.799552882559168450

x	y	z
0.801205809480143420	0.501364690351200460	0.799552882559168450
0.459185522385636040	0.759849426897001190	-0.461589927666278820
-0.673957731845823190	-0.010428699492232388	-0.666214518472055370
-0.354420321271875120	-1.435903044388611400	-0.297942957604386100
0.000000000000000000	0.000000000000000000	-1.078867121557249200
1.000000000000000000	1.000000000000000000	0.000000000000000000

MEC Space Curve

x	y	z
-1.000000000000000000	1.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	0.914949164956981640
0.097129959958679096	-1.095470031849944800	0.267541422448963510
0.767407666626231830	-0.079916432757612371	-0.732462279400721730
0.473671514190957710	-0.779045432860106970	0.510933878695110200
-0.821502212764560920	0.519297949993124290	0.797115282295676520
-0.821502212764560920	0.519297949993124290	0.797115282295676520
0.472386037860052120	-0.776931215655485170	0.509547277668780390
0.763556864891897220	-0.079991163385507505	-0.728158971755585080
-0.017147060641873518	1.417728906584188000	-0.127845774636541370
1.042148273769049700	0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	1.000000000000000000
0.000000000000000000	0.000000000000000000	1.000000000000000000
1.042148273769657700	0.000000000000000000	0.000000000000000000
0.017147060642242903	1.417728906585842300	-0.127845774636690560
-0.763556864891930530	-0.079991163384028757	-0.728158971756630470
0.472386037859937990	0.776931215655080390	-0.509547277668360170
0.821502212764325670	0.519297949993114070	0.797115282295383860
0.821502212764325670	0.519297949993114070	0.797115282295383860
0.473671514191492340	0.779045432860768660	-0.510933878695388870
-0.767407666628735500	-0.079916432756948250	-0.732462279403384260
-0.097129959958063214	-1.095470031848894600	0.267541422448927150
0.000000000000000000	0.000000000000000000	-0.914949164956570640
1.000000000000000000	1.000000000000000000	0.000000000000000000

Figure 4.21. Jörg Peters' Helix — The MVC Curve

```
(G2Joint    mg  (6.28319,   0.0,      9.42478))
(G2Joint    mf  (3.14159,   3.14159,  7.85398))
(G2Joint    me  (0.0,       0.0,      6.28319))
(G2Joint    md  (3.14159,   -3.14159, 4.71239))
(G2Joint    mc  (6.28319,   0.0,      3.14159))
(G2Joint    mb  (3.14159,   3.14159,  1.5708))
(G2Joint    a   (0.0,       0.0,      0.0))
(G2Joint    b   (-3.14159,  -3.14159, -1.5708))
(G2Joint    c   (-6.28319,  0.0,      -3.14159))
```

(G2Joint d (-3.14159, 3.14159, -4.71239))
(G2Joint e (0.0, 0.0, -6.28319))
(G2Joint f (-3.14159, -3.14159, -7.85398))
(G2Joint g (-6.28319, 0.0, -9.42478))
(G2Curve test Open (mg,mf,me,md,mc,mb,a,b,c,d,e,f,g))

MVC Peter's Helix

x	y	z
6.283190000000000300	0.000000000000000000	9.424780000000000200
-0.198240501864768960	5.127592600184613900	-0.900498439689743630
-7.404660987479192400	-0.654288223753734300	-2.267244200646349100
-0.140132511716231200	-7.516237976810065100	0.299115663624224590
-4.820838993551762800	-0.003459456191450867	-1.785574826772078800
3.141589999999999900	3.141589999999999900	7.853980000000000000
3.141589999999999900	3.141589999999999900	7.853980000000000000
-4.851087569079537000	-0.003481162708103279	-1.796778497975442200
-0.185518691475120960	-7.610887154301886800	0.286724012404223410
7.855946991046825400	-0.089657324579906605	-0.027644305879624534
-0.037930411637132122	-4.986766677999626500	-1.417156959629212400
0.000000000000000000	0.000000000000000000	6.283190000000000300
0.000000000000000000	0.000000000000000000	6.283190000000000300
-0.038062279945965435	-5.004103597373588600	-1.422083826582449800
7.910474014794299800	-0.115480529804041570	-0.034997916477095381
-0.411394914821889610	7.710277951899867900	-0.067823414221496167
4.869476633292717500	0.085815221954173918	-1.742240617382419900
3.141589999999999900	-3.141589999999999900	4.712390000000000100
3.141589999999999900	-3.141589999999999900	4.712390000000000100
4.814429316149434300	0.084845118163894839	-1.722545344352614200
-0.380113356894011490	7.537328876903091100	-0.074181743874287415
-7.618766674143293100	0.819069738500618590	0.234502932609861210
0.253621279605101450	5.072492160672243100	-1.333164698668582100
6.283190000000000300	0.000000000000000000	3.141589999999999900
6.283190000000000300	0.000000000000000000	3.141589999999999900
0.260683315091404470	5.213734723987268900	-1.370286411900781400
-8.047051228319658000	0.903492938509249170	0.237711021040665050
1.440934205972207200	-8.800287657189658200	-0.125059871504051120
-4.846279367174115100	-0.678215956157780410	-1.881345255957855200
3.141589999999999900	3.141589999999999900	1.570800000000000000
3.141589999999999900	3.141589999999999900	1.570800000000000000
-4.652827031292924100	-0.651143133687143050	-1.806246276557444700
1.299468628608854600	-8.115755520425958400	-0.126425724169441480
-0.005520690153294453	-0.011559048132690753	-0.003693813207739863
-1.955286538167493800	-4.093917713230832900	-1.308253685509470600
0.000000000000000000	0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	0.000000000000000000

x	y	z
-1.955286538167488900	-4.093917713230822200	-1.308253685509467300
0.005520690153339702	0.011559048132735238	0.003693813207774506
-1.299468628608771500	8.115755520425928200	0.126425724169473120
-4.652827031292915200	-0.651143133687150600	-1.806246276557443900
-3.141589999999999900	-3.141589999999999900	-1.570800000000000000
-3.141589999999999900	-3.141589999999999900	-1.570800000000000000
-4.846279367174099100	-0.678215956157787400	-1.881345255957851800
-1.440934205972111500	8.800287657189599600	0.125059871504085620
8.047051228319849900	-0.903492938508873690	-0.237711021040795330
0.260683315091416850	5.213734723987325700	-1.370286411900804500
-6.283190000000000300	0.000000000000000000	-3.141589999999999900
-6.283190000000000300	0.000000000000000000	-3.141589999999999900
0.253621279605114050	5.072492160672310600	-1.333164698668607700
7.618766674143470800	-0.819069738501116530	-0.234502932609762570
0.380113356893867600	-7.537328876903044000	0.074181743874357817
4.814429316149421800	0.084845118163913241	-1.722545344352605100
-3.141589999999999900	3.141589999999999900	-4.712390000000000100
-3.141589999999999900	3.141589999999999900	-4.712390000000000100
4.869476633292676700	0.085815221954192028	-1.742240617382400800
0.411394914821723970	-7.710277951899732900	0.067823414221572342
-7.910474014794523600	0.115480529803705240	0.034997916476944835
-0.038062279945982401	-5.004103597373649800	-1.422083826582474500
0.000000000000000000	0.000000000000000000	-6.283190000000000300
0.000000000000000000	0.000000000000000000	-6.283190000000000300
-0.037930411637148269	-4.986766677999588300	-1.417156959629208800
-7.855946991046735700	0.089657324579462072	0.027644305879443502
0.185518691475364090	7.610887154301903700	-0.286724012404107220
-4.851087569079542300	-0.003481162708118615	-1.796778497975445100
-3.141589999999999900	-3.141589999999999900	-7.853980000000000000
-3.141589999999999900	-3.141589999999999900	-7.853980000000000000
-4.820838993551763700	-0.003459456191466105	-1.785574826772080100
0.140132511716462100	7.516237976810067800	-0.299115663624112630
7.404660987479128500	0.654288223753565660	2.267244200646340700
-0.198240501864756030	5.127592600184594400	-0.900498439689733530
-6.283190000000000300	0.000000000000000000	-9.424780000000000200

MEC Peter's Helix

x	y	z
6.283190000000000300	0.000000000000000000	9.424780000000000200
-2.142965239510339300	4.020970800200585100	-1.312064723484967600
-0.215140634044518440	0.383258582772364240	-0.117137413288213140
-1.812106081661876800	-7.867670142582347200	0.316973145218641730
-4.503273658465318800	0.813561531701879840	-1.780651914983478500
3.141589999999999900	3.141589999999999900	7.853980000000000000

x	y	z
3.141589999999999900	3.141589999999999900	7.853980000000000000
-4.798681291567134200	0.866929882082043800	-1.897459865704987000
-2.088162595492970600	-8.928226326126948100	0.347856525658778890
7.279794298335967400	1.115101854507194700	-0.418291699749942070
0.263423938997219280	-5.323546162802631300	-1.367503540802859500
0.000000000000000000	0.000000000000000000	6.283190000000000300
0.000000000000000000	0.000000000000000000	6.283190000000000300
0.255758938323335960	-5.168643821425973800	-1.327712489155490600
6.865503483548182300	0.986594959247617640	-0.410886712156491090
-0.007070736580352500	7.206526877641582700	0.003487890560489223
4.825839620230559600	0.000259694436204610	-1.731093005485156500
3.141589999999999900	-3.141589999999999900	4.712390000000000100
3.141589999999999900	-3.141589999999999900	4.712390000000000100
4.830667445462973200	0.000259954237493192	-1.732824810756202100
0.033688215022310258	7.220955268303451500	-0.011130983959190335
-6.799482809146049100	0.882088524096727560	0.428130848969397850
0.255972174237975860	5.145304589834865700	-1.322378914581311400
6.283190000000000300	0.000000000000000000	3.141589999999999900
6.283190000000000300	0.000000000000000000	3.141589999999999900
0.262956002657292080	5.285686740853824600	-1.358458099642151400
-7.172244838370619200	0.997763227669373310	0.434621472247647520
1.857795968323474600	-9.287335707758302300	-0.486655599332728390
-4.883088638107976100	-0.881031929781648240	-1.930493251785411000
3.141589999999999900	3.141589999999999900	1.570800000000000000
3.141589999999999900	3.141589999999999900	1.570800000000000000
-4.571504427978734200	-0.824814306411612240	-1.807310721301907100
1.566894481023706400	-8.150995670518637900	-0.450796546722077200
-0.006869497376285692	-0.012872590403354202	-0.004201878221504241
-2.073789164863796500	-3.886024994251078300	-1.268478470915351600
0.000000000000000000	0.000000000000000000	0.000000000000000000
0.000000000000000000	0.000000000000000000	0.000000000000000000
-2.073789164863798300	-3.886024994251081400	-1.268478470915352500
0.006869497376243054	0.012872590403257687	0.004201878221473569
-1.566894481023829200	8.150995670518637900	0.450796546722038730
-4.571504427978743100	-0.824814306411609800	-1.807310721301911700
-3.141589999999999900	-3.141589999999999900	-1.570800000000000000
-3.141589999999999900	-3.141589999999999900	-1.570800000000000000
-4.883088638107977900	-0.881031929781644240	-1.930493251785413000
-1.857795968323610900	9.287335707758270300	0.486655599332682040
7.172244838370545500	-0.997763227669457690	-0.434621472247623710
0.262956002657292910	5.285686740853798900	-1.358458099642145800
-6.283190000000000300	0.000000000000000000	-3.141589999999999900
-6.283190000000000300	0.000000000000000000	-3.141589999999999900
0.255972174237978190	5.145304589834871000	-1.322378914581314100
6.799482809146059700	-0.882088524096800390	-0.428130848969384800

x	y	z
-0.033688215022069729	-7.220955268303578500	0.011130983959117735
4.830667445463007000	0.000259954237489609	-1.732824810756212800
-3.141589999999999900	3.141589999999999900	-4.712390000000000100
-3.141589999999999900	3.141589999999999900	-4.712390000000000100
4.825839620230588900	0.000259694436201030	-1.731093005485165600
0.007070736580596062	-7.206526877641695500	-0.003487890560562922
-6.865503483548194700	-0.986594959248261020	0.410886712156361360
0.255758938323330240	-5.168643821425987100	-1.327712489155492100
0.000000000000000000	0.000000000000000000	-6.283190000000000300
0.000000000000000000	0.000000000000000000	-6.283190000000000300
0.263423938997212780	-5.323546162802632200	-1.367503540802858000
-7.279794298335948700	-1.115101854507838400	0.418291699749811170
2.088162595492710800	8.928226326126822000	-0.347856525658837850
-4.798681291567096000	0.866929882082041360	-1.897459865704975500
-3.141589999999999900	-3.141589999999999900	-7.853980000000000000
-3.141589999999999900	-3.141589999999999900	-7.853980000000000000
-4.503273658465287700	0.813561531701878500	-1.780651914983469600
1.812106081661653000	7.867670142582254800	-0.316973145218694070
0.215140634044485800	-0.383258582772301290	0.117137413288193300
-2.142965239510338000	4.020970800200581500	-1.312064723484964700
-6.283190000000000300	0.000000000000000000	-9.424780000000000200

Figure 4.22. Coving Design.

```
(G2Joint a (0.5,-12,0)
         (Fixed Tangent (0,1,0)) (Fixed Curvature (0.27,0,0)))
(G2Joint b (20,-0.5,0)
         (Fixed Tangent (1,0,0)))
(G2Curve test Open (a,b))
```

Appendix B
Test Network and Surface Definitions and Results

In this appendix we provide the Bézier patch definitions computed for the interpolation problems described in Chapters 5 and 6. Because of their voluminous nature, some solutions have been omitted. In most cases, the network solutions correspond to the perimeter of the patches provided. All solutions are provided in terms of Bézier control points, either triangular or tensor product patches. In cases where a solution possesses symmetry, only one instance of each unique patch is provided.

Figure 5.9. Octahedron.
Figure 6.17. Octahedron.

Quintic Triangular Bézier Patch		
x	y	z
1.2246465878873718e-16	y1.4997592652241824e-32	1.0
8.3969953450706316e-17	0.31433317757768608	1.0
3.0299919591783472e-17	0.62907565454315328	0.87649331684239362
-9.113645065713357e-18	0.87649331684239362	0.62907565454315362
-1.0458311156693061e-16	1.0	0.31433317757768642
-1.7797581001999499e-16	1.0	2.7755575615628914e-16
0.3143331775776862	3.8494705338030874e-17	1.0
0.40028275364196442	0.40015801734831902	1.0000234314342797
0.42988520970532879	0.78523097313237966	0.7856096621114711
0.40015801734831902	1.0000234314342797	0.40028275364196464
0.31433317757768597	1.0	1.8671406114570802e-16
0.6290756545431534	7.7039535385928788e-17	0.87649331684239351
0.78560966211147165	0.42988520970532912	0.78523097313237955
0.78523097313237977	0.78560966211147143	0.4298852097053289

Quintic Triangular Bézier Patch		
x	y	z
0.62907565454315328	0.87649331684239395	6.1474088550453253e-17
0.87649331684239429	2.7704787508089549e-16	0.62907565454315295
1.00002343143428	0.40028275364196486	0.4001580173483188
0.87649331684239351	0.62907565454315384	-5.1339999758081665e-18
1.0000000000000004	3.9446007822497554e-16	0.31433317757768575
1.0000000000000002	0.31433317757768658	-1.961927929748761e-16
1.0000000000000002	4.5553156617628415e-16	-3.4450926371376849e-16

Figure 5.14. TetraThing.

Figure 6.23. Flexible Frame Comparison①

Quintic Tensor Product Bézier Patch		
x	y	z
-1.10894	-1.10894	-1.10894
-1.2153562480759041	-1.2153562480759041	-0.89610750384819204
-1.2784415348988749	-1.2784415348988749	-0.63922300438420709
-1.1948822417048364	-1.1948822417048364	-0.3680167802199949
-1.0602242672337785	-1.0602242672337785	-0.19871020242421106
-0.90450600000000003	-0.90450600000000003	-0.13700699999999999
-1.6222042306722075	-0.85230788466389629	-0.85230788466389629
-1.7286204787481116	-0.95872413273980017	-0.63947538851208829
-1.7917057655710824	-1.0218094195627709	-0.38259088904810334
-1.474005551806469	-0.90754630205625131	-0.36638965723573425
-1.3393475773354111	-0.77288832758519344	-0.19708307943995035
-1.1836293101016326	-0.61717006035141497	-0.13537987701573928
-1.8820802013215752	-0.34223710605948665	-0.34223710605948665
-1.9884964493974793	-0.44865335413539076	-0.12940460990767866
-2.05158173622045	-0.51173864095836152	0.12747988955630629
-1.7472461350271424	-0.61291030162707139	-0.33625840753141689
-1.612588160556085	-0.47825232715601351	-0.16695182973563305
-1.4568698933223063	-0.32253405992223505	-0.10524862731142201
-1.8820768791582174	0.34224077434868216	0.34224077434868216
-1.988490128170572	0.12941427632397318	0.44865402336103655
-2.0515679371343851	-0.1274686224065269	0.51173183232484964
-1.7629381500309518	0.34258121220555737	0.62937148433947332
-1.6282690163028	0.17321239871570493	0.49470235061132195
-1.4725265645295451	0.11147765335898771	0.33895989883806676
-1.6222019241586265	0.8523090379206868	0.8523090379206868
-1.7286151731709807	0.63948253989597781	0.95872228693304118
-1.7916929821347938	0.38259964116547773	1.0218000958968543
-1.4817754299560133	0.36969470557858852	0.9160526110128977
-1.3471062962278619	0.20032589208873602	0.78138347728474611
-1.1913638444546069	0.13859114673201881	0.62564102551149103
-1.10894	1.10894	1.10894

Quintic Tensor Product Bézier Patch		
x	y	z
-1.2153532490123544	0.89611350197529105	1.2153532490123544
-1.2784310579761675	0.63923060324479097	1.2784310579761675
-1.1949175855014067	0.36811055884656968	1.1949175855014067
-1.0602484517732551	0.19874174535671721	1.0602484517732551
-0.90450600000000003	0.13700699999999999	0.90450600000000003
-0.90450600000000003	-0.90450600000000003	-0.13700699999999999
-0.78414914723503104	-0.78414914723503104	-0.089315721505687867
-0.65094561409127816	-0.65094561409127816	-0.10580115961905867
-0.54828868502670169	-0.54828868502670169	-0.20872377675715009
-0.48988594493195969	-0.48988594493195969	-0.32004711013608061
-0.43327300000000002	-0.43327300000000002	-0.43327300000000002
-1.1836293101016326	-0.61717006035141497	-0.13537987701573928
-1.0632724573366636	-0.49681320758644598	-0.087688598521427158
-0.93006892419291076	-0.3636096744426931	-0.10417403663479796
-0.82385009976447887	-0.41050797765781311	-0.070943069388261559
-0.76544735966973687	-0.35210523756307111	-0.18226640276719208
-0.7088344147377772	-0.29549229263111143	-0.29549229263111143
-1.4568698933223063	-0.32253405992223505	-0.10524862731142201
-1.3365130405573376	-0.20217720715726606	-0.057557348817109888
-1.2033095074135844	-0.068973674013513175	-0.074042786930480692
-1.1109323516153615	-0.28320844416137936	0.056356464108172299
-1.0525296115206195	-0.22480570406663736	-0.054966869270758223
-0.99591666658865974	-0.16819275913467763	-0.16819275913467763
-1.4725265645295451	0.11147765335898771	0.33895989883806676
-1.35263638359968	0.06376758945395905	0.21812721669000545
-1.2198385855572318	0.080302590227123605	0.084471866161901055
-1.1121008178275857	-0.055874996282832157	0.28277902436530278
-1.0531981595211592	0.055413860931337489	0.22480739286188323
-0.99610035876928582	0.16860357996335873	0.16860357996335873
-1.1913638444546069	0.13859114673201881	0.62564102551149103
-1.0714736635247415	0.090881082826990145	0.50480834336342983
-0.93867586548229354	0.1074160836001547	0.37115299283532543
-0.82494640280325604	0.071228070155861412	0.4098820908039964
-0.76604374449682955	0.18251692737003111	0.35191045930057685
-0.70894594374495612	0.29570664640205235	0.29570664640205235
-0.90450600000000003	0.13700699999999999	0.90450600000000003
-0.78461581907013467	0.089296936094971316	0.78367331785193883
-0.65181802102768671	0.1058319368681359	0.65001796732383432
-0.54927345905829983	0.20879442375380913	0.54744844440194407
-0.49037080075187356	0.32008328096797878	0.48947681289852452
-0.43327300000000002	0.43327300000000002	0.43327300000000002

Figure 5.15. Cylinder Blending.

Figure 6.2. The Blend of Two Pipes.

Quintic Tensor Product Bézier Patch		
x	y	z
1	0	-0.8125
1	0.3230000101622772	-0.92065681475376948
0.86958874179396117	0.63513403301773375	-1.061406887955747
0.63513403301773275	0.8695887417939614	-1.2010931120442534
0.3230000101622767	1	-1.3418431852462307
0	1	-1.45
1	0	-1.05
0.99315204069659258	0.314930952490658	-1.1498647804731514
0.87643801006704336	0.60486690672135979	-1.2929503264563043
0.6457486221953348	0.86993581355265137	-1.3557470346889169
0.32498796666110419	1.0012731165838109	-1.5182059564911066
0	1	-1.5600000000000001
1	0	-1.2875000000000001
0.99248442446329088	0.31451531287606144	-1.3827058735744191
0.86891349638816007	0.62233751294202244	-1.5213569193950307
0.63364503902498848	0.87459293056197451	-1.4421063221212731
0.31667039034233846	1.0009322096917295	-1.6348772633979933
0	1	-1.6700000000000002
1	0	-1.5249999999999999
0.9924105672092266	0.30740220918580152	-1.5356568575503167
0.87302641414183568	0.62289246777101137	-1.5174121917859147
0.63277471612037584	0.8711763691504536	-1.7529099374090522
0.321724393667429	1.0006999088069031	-1.7546226736351254
0	1	-1.7799999999999998
1	0	-1.7625
0.99303767891626304	0.31341838809297273	-1.7610991369147821
0.87196870261149739	0.62553644220655125	-1.7584819112921133
0.62964944631122444	0.87753400178645002	-1.8741935834980303
0.31185797203078258	1.000571111961942	-1.8686678246774151
0	1	-1.8899999999999999
1	0	-2
1	0.31365282659954213	-2
0.87702738045764694	0.62755898835409096	-2
0.62755898835409007	0.87702738045764739	-2
0.31365282659954169	1	-2
0	1	-2
0.43301270190000002	2	-0.25
0.38064973256762019	2	-0.34069532332048252
0.30453330734992029	2	-0.4176952279421326
0.20946802481019455	2	-0.47258119441477586
0.10472593868803298	2	-0.5
0	2	-0.5

Quintic Tensor Product Bézier Patch		
x	y	z
0.4855827587959986	1.5429870629264815	-0.15894599049770772
0.47404788453971286	1.514507886009604	-0.21290113745736447
0.41370966624127697	1.5371909088984252	-0.34456898232458383
0.28391033067634391	1.5396514086458901	-0.43385911137353994
0.15245224347016859	1.5727449556379975	-0.49585067168939484
0	1.6401875864270259	-0.5
0.52575824293905127	1.0900805809528458	-0.034087793098807218
0.43104868005888131	1.2831060858568055	-0.2741275245319435
0.37064483387039332	1.1980303839115611	-0.34472837036197063
0.3787947532065476	1.4080428011308099	-0.38985089026796088
0.23653891713306194	1.1233892301577799	-0.52555456204036322
0	1.283625966079063	-0.5
0.83180233740289444	0.85330737815971869	-0.2656703280564926
0.82216811187420102	0.83838861148311894	-0.49597245622842195
0.61809771155219295	1.0985439631872196	-0.58243515723542705
0.52232068323247427	0.83000356590190216	-0.59012733148693663
0.3054397869501615	1.2208968555305644	-0.94803480279284758
0	1	-0.82068253079323017
1	0.36682165977172676	-0.47484020886857914
0.89413609496918123	0.49528954384792062	-0.47803031213233499
0.82909953361968747	0.6982196352065424	-0.64843526981167643
0.58909191615379219	0.82762821373160866	-1.0518396791452973
0.45026130445998092	0.95771058521539254	-0.83419126020653944
0	1	-1.1343191321345052
1	0	-0.8125
1	0.3230000101622772	-0.92065681475376948
0.86958874179396117	0.63513403301773375	-1.061406887955747
0.63513403301773275	0.8695887417939614	-1.2010931120442534
0.3230000101622767	1	-1.3418431852462307
0	1	-1.45
1	0	0.8125
1	0.36682165977172676	0.47484020886857914
0.83180233740289444	0.85330737815971869	0.2656703280564926
0.52575824293905127	1.0900805809528458	0.034087793098807218
0.4855827587959986	1.5429870629264815	0.15894599049770772
0.43301270190000002	2	0.25
1	0	0.48750000000000004
0.96253290128242419	0.31994132592106367	0.12700280251329771
0.88792135129784067	0.92312364807749114	0.11556936022894462
0.52832000597974027	1.024332611017982	0.027738102103180458
0.49525226248946203	1.5397124494253354	0.10677723746199662
0.48537567121674913	2	0.15930467670659065
1	0	0.16250000000000009

Quintic Tensor Product Bézier Patch		
x	y	z
0.98321853978383833	0.25355009988457028	0.12871952601076664
0.88661332628517886	0.91736237553117239	-0.0031605897227102225
0.5178701665361245	1.0762601595352079	0.005281199327259936 5
0.50445274049111766	1.5066455812750585	0.041970737411966406
0.5140013320962119	2	0.054885966546680098
1	0	-0.16250000000000009
0.98321853978383833	0.25355009988457028	-0.12871952601076664
0.88661332628517886	0.91736237553117239	0.0031605897227102225
0.5178701665361245	1.0762601595352079	-0.005281199327259936 5
0.50445274049111766	1.5066455812750585	-0.041970737411966406
0.5140013320962119	2	-0.054885966546680098
1	0	-0.48750000000000004
0.96253290128242419	0.31994132592106367	-0.12700280251329771
0.88792135129784067	0.92312364807749114	-0.11556936022894462
0.52832000597974027	1.024332611017982	-0.027738102103180458
0.49525226248946203	1.5397124494253354	-0.10677723746199662
0.48537567121674913	2	-0.15930467670659065
1	0	-0.8125
1	0.36682165977172676	-0.47484020886857914
0.83180233740289444	0.85330737815971869	-0.2656703280564926
0.52575824293905127	1.0900805809528458	-0.034087793098807218
0.4855827587959986	1.5429870629264815	-0.15894599049770772
0.43301270190000002	2	-0.25
0.43301270190000002	3	-0.25
0.38064973256762019	3	-0.34069532332048252
0.30453330734992029	3	-0.4176952279421326
0.20946802481019455	3	-0.47258119441477586
0.10472593868803298	3	-0.5
0	3	-0.5
0.43301270190000002	2.7999999999999998	-0.25
0.38064973256762019	2.7999999999999998	-0.34069532332048258
0.30453330734992029	2.7999999999999998	-0.41769522794213265
0.20946802481019455	2.7999999999999998	-0.47258119441477586
0.10472593868803298	2.7999999999999998	-0.5
0	2.7999999999999998	-0.5
0.43301270190000002	2.5999999999999996	-0.25
0.38064973256762019	2.5999999999999996	-0.34069532332048258
0.30453330734992029	2.5999999999999996	-0.41769522794213265
0.20946802481019455	2.5999999999999996	-0.47258119441477586
0.10472593868803298	2.5999999999999996	-0.5
0	2.5999999999999996	-0.5
0.43301270190000002	2.4000000000000004	-0.25
0.38064973256762019	2.4000000000000004	-0.34069532332048258

Quintic Tensor Product Bézier Patch		
x	y	z
0.30453330734992029	2.4000000000000004	-0.41769522794213265
0.20946802481019455	2.4000000000000004	-0.47258119441477586
0.10472593868803298	2.4000000000000004	-0.5
0	2.4000000000000004	-0.5
0.43301270190000002	2.2000000000000002	-0.25
0.38064973256762019	2.2000000000000002	-0.34069532332048258
0.30453330734992029	2.2000000000000002	-0.41769522794213265
0.20946802481019455	2.2000000000000002	-0.47258119441477586
0.10472593868803298	2.2000000000000002	-0.5
0	2.2000000000000002	-0.5
0.43301270190000002	2	-0.25
0.38064973256762019	2	-0.34069532332048252
0.30453330734992029	2	-0.4176952279421326
0.20946802481019455	2	-0.47258119441477586
0.10472593868803298	2	-0.5
0	2	-0.5
0.43301270190000002	3	0.25
0.48537567121674863	3	0.1593046767065916
0.51400133209621135	3	0.054885966546682319
0.51400133209621135	3	-0.054885966546682319
0.48537567121674863	3	-0.1593046767065916
0.43301270190000002	3	-0.25
0.43301270190000002	2.7999999999999998	0.25
0.48537567121674857	2.7999999999999998	0.1593046767065916
0.51400133209621135	2.7999999999999998	0.054885966546682319
0.51400133209621135	2.7999999999999998	-0.054885966546682319
0.48537567121674857	2.7999999999999998	-0.1593046767065916
0.43301270190000002	2.7999999999999998	-0.25
0.43301270190000002	2.5999999999999996	0.25
0.48537567121674857	2.5999999999999996	0.1593046767065916
0.51400133209621135	2.5999999999999996	0.054885966546682319
0.51400133209621135	2.5999999999999996	-0.054885966546682319
0.48537567121674857	2.5999999999999996	-0.1593046767065916
0.43301270190000002	2.5999999999999996	-0.25
0.43301270190000002	2.4000000000000004	0.25
0.48537567121674857	2.4000000000000004	0.1593046767065916
0.51400133209621135	2.4000000000000004	0.054885966546682319
0.51400133209621135	2.4000000000000004	-0.054885966546682319
0.48537567121674857	2.4000000000000004	-0.1593046767065916
0.43301270190000002	2.4000000000000004	-0.25
0.43301270190000002	2.2000000000000002	0.25
0.48537567121674857	2.2000000000000002	0.1593046767065916
0.51400133209621135	2.2000000000000002	0.054885966546682319

Quintic Tensor Product Bézier Patch		
x	y	z
0.51400133209621135	2.2000000000000002	-0.054885966546682319
0.48537567121674857	2.2000000000000002	-0.1593046767065916
0.43301270190000002	2.2000000000000002	-0.25
0.43301270190000002	2	0.25
0.48537567121674913	2	0.15930467670659065
0.5140013320962119	2	0.054885966546680098
0.5140013320962119	2	-0.054885966546680098
0.48537567121674913	2	-0.15930467670659065
0.43301270190000002	2	-0.25

Figure 6.22. Three Handles.

Quintic Tensor Product Bézier Patch		
x	y	z
-0.82898899999999998	0.87407400000000002	0.72850099999999995
-1.0248362747225066	0.59588014737159567	0.84154394046907943
-1.1471151972523397	0.24846263258590828	0.91212326805864319
-1.1471151972523397	-0.24846263258590828	0.91212326805864319
-1.0248362747225066	-0.59588014737159567	0.84154394046907943
-0.82898899999999998	-0.87407400000000002	0.72850099999999995
-0.78439940369675654	0.87512203116249732	0.80404850511282577
-0.98412956874094693	0.58982712297719819	0.92328900576506467
-1.1124001565732935	0.24132242892335026	0.96682734564590078
-1.1124001565732935	-0.24132242892335026	0.96682734564590078
-0.98412956874094693	-0.58982712297719819	0.92328900576506467
-0.78439940369675654	-0.87512203116249732	0.80404850511282577
-0.71009844903014496	0.8491074540062552	0.86241095715047289
-0.94206539040767157	0.51954082220551079	1.010243944797379
-1.0453524456041947	0.20631744805243166	0.99747071427491396
-1.0453524456041947	-0.20631744805243166	0.99747071427491396
-0.94206539040767157	-0.51954082220551079	1.010243944797379
-0.71009844903014496	-0.8491074540062552	0.86241095715047289
-0.6237607726562242	0.79892324802041093	0.86532102077979833
-0.78491326005310158	0.5309706857243226	1.0186160171390848
-1.0133115560299064	0.35480479529413028	1.0334836889961569
-1.0133115560299064	-0.35480479529413028	1.0334836889961569
-0.78491326005310158	-0.5309706857243226	1.0186160171390848
-0.6237607726562242	-0.79892324802041093	0.86532102077979833
-0.54805958296574353	0.75481067407012226	0.85354858622139129
-0.72061006589040399	0.47787832549604131	1.0120032295431083
-0.93875088256837824	0.26958391589859049	1.0364031363879886
-0.93875088256837824	-0.26958391589859049	1.0364031363879886
-0.72061006589040399	-0.47787832549604131	1.0120032295431083
-0.54805958296574353	-0.75481067407012226	0.85354858622139129

Quintic Tensor Product Bézier Patch		
x	y	z
-0.48748999999999998	0.70703300000000002	0.82003599999999999
-0.65238823828880477	0.48121819289309581	0.98204674248845059
-0.88617667019940838	0.22457817273761993	1.0317401847481011
-0.88617667019940838	-0.22457817273761993	1.0317401847481011
-0.65238823828880477	-0.48121819289309581	0.98204674248845059
-0.48748999999999998	-0.70703300000000002	0.82003599999999999
-0.48748999999999998	0.70703300000000002	0.82003599999999999
-0.65238823828880477	0.48121819289309581	0.98204674248845059
-0.88617667019940838	0.22457817273761993	1.0317401847481011
-0.88617667019940838	-0.22457817273761993	1.0317401847481011
-0.65238823828880477	-0.48121819289309581	0.98204674248845059
-0.48748999999999998	-0.70703300000000002	0.82003599999999999
-0.42334546634277442	0.65643538198126272	0.78454542685151896
-0.43507242882581248	0.37439826400455162	0.87149605669765262
-0.7396771165849394	0.25281643518706992	1.0256208616674181
-0.7396771165849394	-0.25281643518706992	1.0256208616674181
-0.43507242882581248	-0.37439826400455162	0.87149605669765262
-0.42334546634277442	-0.65643538198126272	0.78454542685151896
-0.37592056561046672	0.60152934906394429	0.7245338497682785
-0.42108632576512445	0.41640022167296353	0.68771634478490085
-0.60604792336885882	0.13631799314567752	0.96577909655868988
-0.60604792336885882	-0.13631799314567752	0.96577909655868988
-0.42108632576512445	-0.41640022167296353	0.68771634478490085
-0.37592056561046672	-0.60152934906394429	0.7245338497682785
-0.33856102588822479	0.55980811697008948	0.64408457548273912
-0.4342019351483728	0.46096933021991576	0.68351591386305988
-0.52939644330327928	0.31412901271413557	0.8545806986023623
-0.52939644330327928	-0.31412901271413557	0.8545806986023623
-0.4342019351483728	-0.46096933021991576	0.68351591386305988
-0.33856102588822479	-0.55980811697008948	0.64408457548273912
-0.35301911948879278	0.53890074827088119	0.55293589538710597
-0.4545897301996491	0.33566759554870856	0.66485749559622076
-0.47099102867013415	0.073394476153425509	0.67684855482367434
-0.47099102867013415	-0.073394476153425509	0.67684855482367434
-0.4545897301996491	-0.33566759554870856	0.66485749559622076
-0.35301911948879278	-0.53890074827088119	0.55293589538710597
-0.395955	0.54000199999999998	0.47853699999999999
-0.50472582210347716	0.35742207834452805	0.54131478644963038
-0.54631635455091598	0.12114405450251586	0.564528465525865
-0.54631635455091598	-0.12114405450251586	0.564528465525865
-0.50472582210347716	-0.35742207834452805	0.54131478644963038
-0.395955	-0.54000199999999998	0.47853699999999999
0	1.2706	0.25000899999999998

Quintic Tensor Product Bézier Patch		
x	y	z
-0.17898602883180981	1.2704742366298216	0.3533196385100289
-0.35797194456496573	1.164893385075789	0.45649894505796312
-0.57272145539309982	1.1778299115881652	0.58058351260988394
-0.71364076336052329	1.0379219289032517	0.66192206053747815
-0.82898899999999998	0.87407400000000002	0.72850099999999995
-4.5469716059109858e-18	1.27048292686325	0.34458232668948885
-0.14382577074108055	1.2510390640673141	0.41489402478719517
-0.19868610650969926	1.2225755505083968	0.45802609945085127
-0.53589390421825467	1.1532234161053208	0.56031642153497618
-0.56042616284593139	1.1279800863368257	0.78034059850402682
-0.78439940369675654	0.87512203116249732	0.80404850511282577
-2.6218846374582329e-07	1.2482898762208703	0.43919028983631492
-0.15867216526395284	1.1942046850705774	0.38103006648549925
-0.068048559485446442	1.2082937704047698	0.50000386576844158
-0.4273239048499694	1.1615796157791927	0.40777023678148255
-0.4352254926403471	1.086926114027565	0.7079097754508944
-0.71009844903014496	0.8491074540062552	0.86241095715047289
-1.3049406400079434e-17	1.167992808634823	0.52142608405970181
-0.19153911925898368	1.2806179480697921	0.41456808406561829
-0.34910886148309545	1.1576898107847811	0.44363161171391419
-0.59332775533031934	1.2236008663047919	0.66922103371271713
-0.52279905203725152	1.0454463873984845	0.71247433162218821
-0.6237607726562242	0.79892324802041093	0.86532102077979833
-1.4842273342982981e-17	1.0486596554745311	0.55871626438138677
-0.21337458815841823	1.1792242050677253	0.58097852296632535
-0.43368175687105892	1.1121130862614723	0.65528397091641399
-0.5649528470120877	0.97207065171069607	0.80063921848218489
-0.50558466199249441	0.89104592824464746	0.80496942542369376
-0.54805958296574353	0.75481067407012226	0.85354858622139129
-1.3877799999999999e-17	0.94021200000000005	0.53865600000000002
-0.13228596863899797	0.94021135902409658	0.53865588143454068
-0.26463618607187145	0.93388640689933722	0.56787671258386307
-0.36364989218767546	0.88733128232580671	0.6680141095481833
-0.41977888326743035	0.7997579006576947	0.75351055733667149
-0.48748999999999998	0.70703300000000002	0.82003599999999999
-1.3877799999999999e-17	0.94021200000000005	0.53865600000000002
-0.13228596863899797	0.94021135902409658	0.53865588143454068
-0.26463618607187145	0.93388640689933722	0.56787671258386307
-0.36364989218767546	0.88733128232580671	0.6680141095481833
-0.41977888326743035	0.7997579006576947	0.75351055733667149
-0.48748999999999998	0.70703300000000002	0.82003599999999999
-1.8937608836095341e-17	0.85539288551482073	0.52296645969852806
-0.083347010920489975	0.77557975897733988	0.50703145328744537

Quintic Tensor Product Bézier Patch		
x	y	z
-0.21240234382416376	0.97583786826068508	0.55034422851109188
-0.33005664311780658	0.81692860359690533	0.64761879754088347
-0.37535374815932837	0.86871511899227039	0.69839910272323169
-0.42334546634277442	0.65643538198126272	0.78454542685151896
-2.2313303921423772e-17	0.77700095696582028	0.47215211181620165
-0.053295914010013525	0.769021202283387	0.41123675194358328
-0.12230009406290061	0.71761160014528858	0.5694426705198764
-0.20385477239154479	0.84214079074882586	0.51563718446958173
-0.24358072806592626	0.84393387246265239	0.62057231428113491
-0.37592056561046672	0.60152934906394429	0.7245338497682785
4.7397427054552721e-07	0.73353743647571334	0.3968004961985131
-0.082554500052897425	0.74650712468968761	0.40379739502657014
-0.12776149201967776	0.7389508560404352	0.34191789587947535
-0.1392754344949784	0.7153396610290349	0.57736937129465693
-0.20987169877811113	0.75427036692725147	0.52063948277541516
-0.33856102588822479	0.55980811697008948	0.64408457548273912
-2.9420817528113086e-17	0.72890516827624741	0.32336341027132293
-0.078746021379715481	0.73230333765638334	0.33447846809361331
-0.15856907591285849	0.72894940555726107	0.39860256354149376
-0.24276526705524454	0.70920502512983175	0.41558653938438256
-0.3000465067364867	0.65117711346038998	0.49762106907432763
-0.35301911948879278	0.53890074827088119	0.55293589538710597
-3.0616199999999999e-17	0.72939799999999999	0.24999099999999999
-0.093247393999886852	0.72904509501639403	0.30381504981274554
-0.1864865004102699	0.73975381149152619	0.35770920544978368
-0.27925583673164323	0.69934389040415357	0.41100918944154996
-0.34498977302502892	0.62555113557705766	0.44912180587245121
-0.395955	0.54000199999999998	0.47853699999999999

Figure 6.23. Flexible Frame Comparison③

Quintic Tensor Product Bézier Patch		
x	y	z
-1.10894	-1.10894	-1.10894
-1.2147082301863934	-1.2147082301863934	-0.89718038469918004
-1.2776037708808012	-1.2775802160609675	-0.64188069109911483
-1.1935621031499215	-1.1942755974381631	-0.36681042988921148
-1.0596703870918551	-1.0596703870918551	-0.19849072799052414
-0.90450600000000003	-0.90450600000000003	-0.13700699999999999
-1.6215494603920129	-0.85260522157844765	-0.85260522157844765
-1.5448127711368123	-0.93274253412464847	-0.73112367314554483
-1.454938477706418	-0.88765265906034252	-0.59051918883766574
-1.6143478836511496	-0.85599784417330849	-0.63992596239053101
-1.6869203496169343	-0.74073106682623724	-0.20795109176333151

Quintic Tensor Product Bézier Patch		
x	y	z
-0.96173129654137535	-0.68455723185234119	-0.10569383639693608
-1.8813634202926104	-0.34330728668243871	-0.34364285302017961
-1.9097432467518372	-0.57360387686483016	-0.2557880354465763
-1.7230035001029798	-0.69655780678464407	-0.17340649983952386
-1.5050944036757772	-0.35174308328833248	0.28785906215443657
-1.192656783186762	-0.36485147616533509	0.24468271115242626
-1.2196724381164508	-0.53866154436187108	-0.1409648816926822
-1.8813634202926104	0.34364285302017966	0.34330728668243876
-1.9097432467518372	0.25578803544657636	0.57360387686483028
-1.7230035001029798	0.17340649983952389	0.69655780678464418
-1.5050944036757772	-0.28785906215443663	0.35174308328833254
-1.192656783186762	-0.24468271115242632	0.36485147616533514
-1.2196724381164508	0.14096488169268223	0.53866154436187119
-1.6215494603920129	0.85260522157844787	0.85260522157844787
-1.5448127711368123	0.73112367314554494	0.93274253412464869
-1.454938477706418	0.59051918883766585	0.88765265906034274
-1.6143478836511496	0.63992596239053112	0.85599784417330871
-1.6869203496169343	0.20795109176333157	0.74073106682623735
-0.96173129654137535	0.10569383639693611	0.6845572318523413
-1.10894	1.1089400000000003	1.1089400000000003
-1.2147082301863934	0.89718038469918027	1.2147082301863936
-1.2776037708808012	0.64188069109911494	1.2775802160609677
-1.1935621031499215	0.36681042988921153	1.1942755974381634
-1.0596703870918551	0.1984907279905242	1.0596703870918553
-0.90450600000000003	0.13700700000000002	0.90450600000000025
-0.90450600000000003	-0.90450600000000003	-0.13700699999999999
-0.78385456594729097	-0.78385456594729097	-0.089198993974931778
-0.65008028030350518	-0.65051167159801371	-0.10588248366391105
-0.54809370436588545	-0.54809115209694192	-0.2094995685912196
-0.48979393457559678	-0.48979393457559678	-0.3204384182875919
-0.43327300000000002	-0.43327300000000002	-0.43327300000000002
-0.96173129654137535	-0.68455723185234119	-0.10569383639693608
-0.97229667146046383	-0.58715498093083729	-0.13543749265185825
-0.94399024917326424	-0.47286920201733079	-0.094827885678770915
-0.85877918016569821	-0.42175861579767321	-0.12513426951313594
-0.70181524604214618	-0.35643115809769133	-0.23732747058434472
-0.70883772955866275	-0.29547196294527273	-0.29547196294527273
-1.2196724381164508	-0.53866154436187108	-0.1409648816926822
-1.1267581567185694	-0.3323477255468002	0.080818777567766023
-1.0125415268529243	-0.26750716175886569	0.091016737820919499
-0.96925900735952497	-0.20880061537810035	0.026150007391291457
-0.99389401444482961	-0.22549085036810496	-0.079957798778805877
-0.99592498953637176	-0.16813931208895116	-0.1681667992281391

Quintic Tensor Product Bézier Patch		
x	y	z
-1.2196724381164508	0.14096488169268223	0.53866154436187119
-1.1267581567185694	-0.080818777567766037	0.33234772554680025
-1.0125415268529243	-0.091016737820919513	0.26750716175886574
-0.96925900735952497	-0.026150007391291464	0.20880061537810041
-0.99389401444482961	0.079957798778805891	0.22549085036810501
-0.99592498953637176	0.16816679922813912	0.16813931208895119
-0.96173129654137535	0.10569383639693611	0.6845572318523413
-0.97229667146046383	0.13543749265185828	0.5871549809308374
-0.94399024917326424	0.094827885678770943	0.4728692020173309
-0.85877918016569821	0.12513426951313597	0.42175861579767332
-0.70181524604214618	0.23732747058434478	0.35643115809769138
-0.70883772955866275	0.29547196294527278	0.29547196294527278
-0.90450600000000003	0.13700700000000002	0.90450600000000025
-0.78385456594729097	0.089198993974931792	0.78385456594729119
-0.65008028030350518	0.10588248366391108	0.65051167159801382
-0.54809370436588545	0.20949956859121965	0.54809115209694204
-0.48979393457559678	0.32043841828759195	0.48979393457559689
-0.43327300000000002	0.43327300000000013	0.43327300000000013

Figure 6.25. MVS Sculptures.①

Quintic Tensor Product Bézier Patch		
x	y	z
0	1	0
0.47699387647330482	1	0.26943847890428824
0.89577498440399683	0.52014665471403454	0.80383772044279556
0.82442949783572039	-0.51984600241131451	0.87313688108667575
0.28228057053614247	-1	0.46860800304575712
0	-1	0
0.46860800304575706	1	-0.28228057053614258
0.8679560290593954	0.27754605487468725	-0.012460753934750688
0.21590286647720325	-0.087117943059129774	0.27203858878548226
0.27272672539632659	0.081948476115392604	0.20555689833734084
0.012460753934750528	-0.27754605487468725	0.8679560290593954
-0.26943847890428835	-1	0.47699387647330477
0.87313688108667564	0.51984600241131451	-0.82442949783572205
0.20555689833734078	-0.081948476115392604	-0.27272672539632664
0.18036368056408972	0.27415202190348137	-0.0006371390848754459
0.0006371390848754128	-0.27415202190348137	0.18036368056408972
-0.27203858878548226	0.087117943059129774	0.21590286647720319
-0.80383772044279567	-0.52014665471403454	0.89577498440399672
0.80383772044279544	-0.52014665471403454	-0.89577498440399672
0.27203858878548215	0.087117943059129774	-0.21590286647720319
-0.00063713908487543481	-0.27415202190348137	-0.18036368056408969

Quintic Tensor Product Bézier Patch		
x	y	z
-0.18036368056408972	0.27415202190348137	0.00063713908487542385
-0.20555689833734081	-0.081948476115392604	0.27272672539632664
-0.87313688108667575	0.51984600241131451	0.82442949783572039
0.26943847890428824	-1	-0.47699387647330477
-0.012460753934750633	-0.27754605487468725	-0.86795602905939528
-0.27272672539632659	0.081948476115392604	-0.20555689833734078
-0.21590286647720322	-0.087117943059129774	-0.2720385887854822
-0.8679560290593954	0.27754605487468725	0.012460753934750582
-0.46860800304575712	1	0.28228057053614253
0	-1	0
-0.28228057053614247	-1	-0.468608003045757
-0.82442949783572039	-0.51984600241131451	-0.87313688108667553
-0.89577498440399672	0.52014665471403454	-0.80383772044279567
-0.47699387647330477	1	-0.26943847890428829
0	1	0