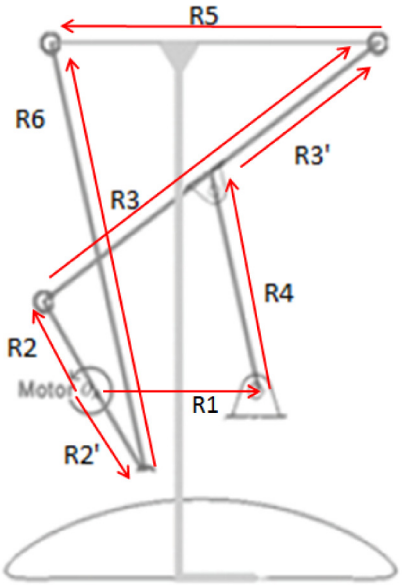


In[1]:=
```
R1 = 1.333;
R2 = 0.8;
R2prime = 0.8;
R3 = 3.7;
R3prime = 1.7;
R4 = 1.8;
R5 = 2.75;
R5prime = 1.75;
R6 = 3.666;
RP = 1;

(* New Values*)
(*R1 = 1.4997; R2 = 0.8; R2prime = 0.8; R3 = 3.63227; R3prime = 1.8653;
R4 = 1.88335; R5 = 2.8632; R5prime = 1.75; R6 = 3.6639;*)
(*R1 = 1.50994; R2 = 0.8; R2prime = 0.8; R3 = 3.73976;
R3prime = 1.87298; R4 = 1.87472; R5 = 3.0179; R6 = 3.74617;*)
(*R1 = 1.5; R2 = 0.8; R2prime = 0.8; R3 = 3.75;
R3prime = 1.85; R4 = 1.85; R5 = 3.05; R6 = 3.75; BEST!*)
R1 = 1.9; R2 = 1; R2prime = 1; R3 = 4.65;
R3prime = 2.3; R4 = 2.35; R5 = 3.65; R6 = 4.65;

fitnessBest = 1000;
n = 1; While[n < 1 000 000,
 {ℛ1 = R1 e^(i 0);
  ℛ2 = R2 e^(i θR2);
  ℛ2prime = R2prime e^(i (θR2+180 °));
  ℛ3 = R3 e^(i θR3);
```

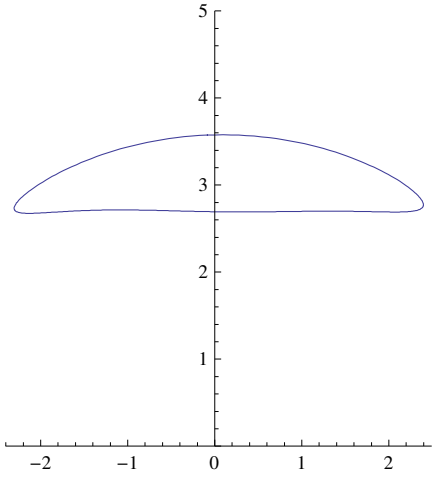
```
ℛ3prime = R3prime e^(i θR3);
ℛ4 = R4 e^(i θR4);
ℛ5 = R5 e^(i θR5);
ℛ5prime = R5prime e^(i θR5);
ℛP = 0;
ℛ6 = R6 e^(i θR6);
ℛP = RP e^(i (θR5+90 °));
θ5 = Table[
    {1, θR5 /. FindRoot[
        {
         Re[ℛ2 + ℛ3prime] == Re[ℛ1 + ℛ4],
         Im[ℛ2 + ℛ3prime] == Im[ℛ1 + ℛ4],
         Re[ℛ2 + ℛ3 + ℛ5] == Re[ℛ2prime + ℛ6],
         Im[ℛ2 + ℛ3 + ℛ5] == Im[ℛ2prime + ℛ6]
        },
        {{ θR3, 45 °}, { θR4, 100 °}, { θR5, 180 °}, { θR6, 90 °}}
       ]
    }, {θR2, 0 °, 360 °, 1 °}] // Quiet;
dy = Table[
    {2.70 - Im[(ℛ2 + ℛ3 + ℛ5prime + ℛP) /. FindRoot[
          {
           Re[ℛ2 + ℛ3prime] == Re[ℛ1 + ℛ4],
           Im[ℛ2 + ℛ3prime] == Im[ℛ1 + ℛ4],
           Re[ℛ2 + ℛ3 + ℛ5] == Re[ℛ2prime + ℛ6],
           Im[ℛ2 + ℛ3 + ℛ5] == Im[ℛ2prime + ℛ6]
          },
          {{ θR3, 45 °}, { θR4, 100 °}, { θR5, 180 °}, { θR6, 90 °}}
         ]
      ]}, {θR2, 80 °, 300 °, 1 °}] // Quiet;
imax = Length[dy[[All]]];
fitnessdy = 2 ∑_i^imax (dy[[i]][[1]])^2;
imax = Length[θ5[[All, 2]]];
fitnessθ5 = ∑_i^imax (π - θ5[[All, 2]][[i]])^2;
totalFitness = fitnessdy + fitnessθ5;
If[totalFitness < fitnessBest,
  {
   fitnessBest = totalFitness;
   Print["Iteration: ", n];
   Print["Fitness of height constraint: ", (1 / fitnessdy)];
   Print["Fitness of angle constraint: ", (1 / fitnessθ5)];
   Print["Overall Fitness: ", totalFitness, "(", (1 / totalFitness), ")"];
   Print["R1 = " <> ToString[R1] <> "; R2 = " <> ToString[R2] <>
     "; R2prime = " <> ToString[R2prime] <> "; R3 = " <> ToString[R3] <>
```

```
  "; R3prime = " <> ToString[R3prime] <> "; R4 = " <> ToString[R4] <>
  "; R5 = " <> ToString[R5] <> "; R6 = " <> ToString[R6] <> ";"];

LinkPath = Table[
   {Re[(ℛ2 + ℛ3 + ℛ5prime + ℛP) /. (θs = FindRoot[
          {
           Re[ℛ2 + ℛ3prime] == Re[ℛ1 + ℛ4],
           Im[ℛ2 + ℛ3prime] == Im[ℛ1 + ℛ4],
           Re[ℛ2 + ℛ3 + ℛ5] == Re[ℛ2prime + ℛ6],
           Im[ℛ2 + ℛ3 + ℛ5] == Im[ℛ2prime + ℛ6]
          },
          {{θR3, 45 °}, {θR4, 100 °}, {θR5, 180 °}, {θR6, 90 °}}
         ])],
    Im[(ℛ2 + ℛ3 + ℛ5prime + ℛP) /. θs]
   }, {θR2, 0 °, 360 °, 1 °}] // Quiet;

θ5 = Table[{θR2, θR5 /. FindRoot[
       {
        Re[ℛ2 + ℛ3prime] == Re[ℛ1 + ℛ4],
        Im[ℛ2 + ℛ3prime] == Im[ℛ1 + ℛ4],
        Re[ℛ2 + ℛ3 + ℛ5] == Re[ℛ2prime + ℛ6],
        Im[ℛ2 + ℛ3 + ℛ5] == Im[ℛ2prime + ℛ6]
       },
       {{θR3, 45 °}, {θR4, 100 °}, {θR5, 180 °}, {θR6, 90 °}}
      ]}, {θR2, 0 °, 360 °, 1 °}] // Quiet;

Print[ListLinePlot[LinkPath, AspectRatio → Automatic,
  PlotRange → 5, ImageSize → 200, PlotLabel → "Path of output link"],
 ListLinePlot[{θ5 / °, {{0, π / °}, {2 π / °, π / °}}}, ImageSize → 500,
  AxesLabel → {"θ2 (°, input link)", "θ5 (°, output link)"},
  PlotLabel → "Angle of output link"]];
R1Last = R1;
(*R2Last=R2;*)
(*R2PLast=R2P;*)
R3Last = R3;
R3PLast = R3prime;
R4Last = R4;
R5Last = R5;
R6Last = R6;
(**)
R1 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
(*R2+=(Random[]-.5)/2;*)
(*R2prime+=(Random[]-.5)/2;*)
R3 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
R3prime += ((Random[] - 0.5) * 5 // Floor) * 0.05;
R4 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
R5 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
R6 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
```

```
          },
          {
           R1 = R1Last;
           (*R2=R2Last;*)
           (*R2P=R2PLast;*)
           R3 = R3Last;
           R3prime = R3PLast;
           R4 = R4Last;
           R5 = R5Last;
           R6 = R6Last;
           (**)
           R1 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
           (*R2+=(Random[]-.5)/2;*)
           (*R2prime+=(Random[]-.5)/2;*)
           R3 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
           R3prime += ((Random[] - 0.5) * 5 // Floor) * 0.05;
           R4 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
           R5 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
           R6 += ((Random[] - 0.5) * 5 // Floor) * 0.05;
          }]
         n++;
       }]
```

```
Iteration: 1

Fitness of height constraint: 21.5479

Fitness of angle constraint: 7.0509

Overall Fitness: 0.188234(5.31254)

R1 = 1.9; R2 = 1; R2prime = 1; R3 =
  4.65; R3prime = 2.3; R4 = 2.35; R5 = 3.65; R6 = 4.65;
```

Path of output link



Angle of output link