

# W3 Probabilistic Road Map

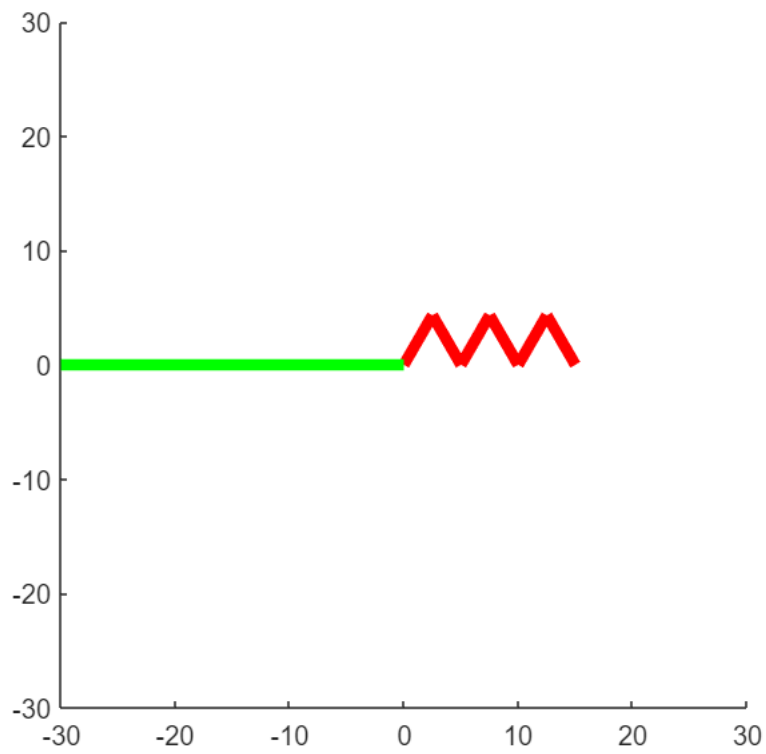
Robotics: Computational Motion Planning

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```
clear;  
close all;  
clc;
```

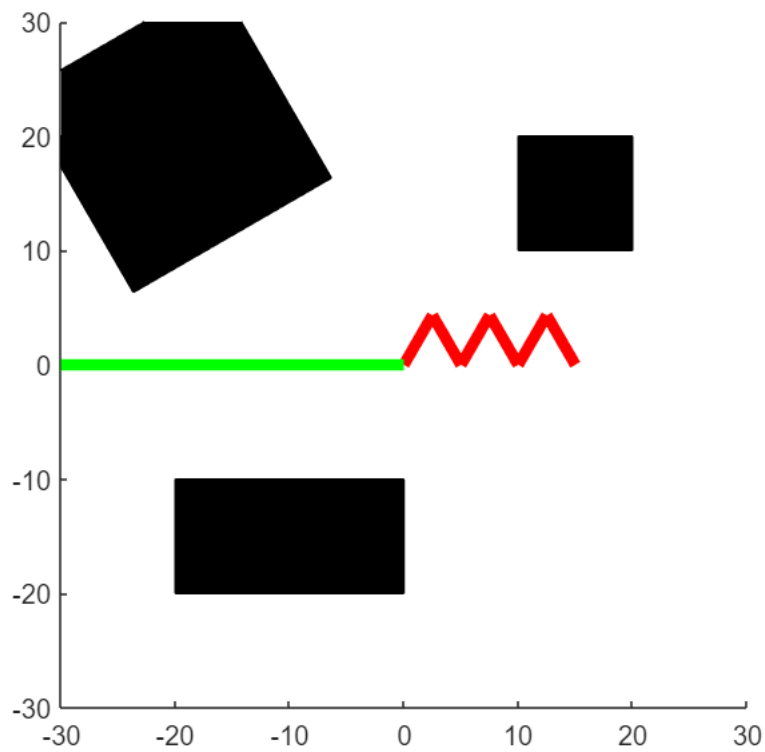
## Drawing the robot

```
figure;  
  
% The SixLinkRobot function computes layout of all of the links in the  
% robot as a function of the 6 configuration space parameters. You can  
% adjust these six numbers to see what happens.  
fv = SixLinkRobot ([-120 120 -120 120 -120 60]);  
fv2 = SixLinkRobot ([0 0 0 0 0 180]);  
  
p = patch (fv);  
  
p.FaceColor = 'red';  
p.EdgeColor = 'none';  
  
p2 = patch(fv2);  
p2.FaceColor = 'green';  
p2.EdgeColor = 'none';  
  
sz = 30;  
axis equal;  
axis (sz*[-1 1 -1 1]);
```



## Add Obstacles

```
obstacle = boxFV(10, 20, 10, 20);  
obstacle = appendFV (obstacle, boxFV(-20, 0, -20, -10));  
obstacle = appendFV (obstacle, transformFV(boxFV(-10, 10, -10, 10), 30, [-20 20]));  
  
patch (obstacle);
```



## Build Roadmap

```
nsamples = 200;
neighbors = 5;
```

```
roadmap = PRM (@()(RandomSampleSixLink(obstacle)), @DistSixLink, @(x,y)(LocalPlannerSixLink(x,y
```

```
nsamples = 2, nedges = 0
nsamples = 3, nedges = 2
nsamples = 4, nedges = 2
nsamples = 5, nedges = 5
nsamples = 6, nedges = 8
nsamples = 7, nedges = 10
nsamples = 8, nedges = 13
nsamples = 9, nedges = 16
nsamples = 10, nedges = 21
nsamples = 11, nedges = 26
nsamples = 12, nedges = 31
nsamples = 13, nedges = 34
nsamples = 14, nedges = 37
nsamples = 15, nedges = 39
nsamples = 16, nedges = 43
nsamples = 17, nedges = 46
nsamples = 18, nedges = 50
nsamples = 19, nedges = 54
nsamples = 20, nedges = 56
nsamples = 21, nedges = 59
nsamples = 22, nedges = 63
nsamples = 23, nedges = 66
nsamples = 24, nedges = 69
nsamples = 25, nedges = 73
```

nsamples = 26, nedges = 78  
nsamples = 27, nedges = 82  
nsamples = 28, nedges = 86  
nsamples = 29, nedges = 91  
nsamples = 30, nedges = 96  
nsamples = 31, nedges = 100  
nsamples = 32, nedges = 105  
nsamples = 33, nedges = 108  
nsamples = 34, nedges = 112  
nsamples = 35, nedges = 117  
nsamples = 36, nedges = 120  
nsamples = 37, nedges = 124  
nsamples = 38, nedges = 128  
nsamples = 39, nedges = 133  
nsamples = 40, nedges = 138  
nsamples = 41, nedges = 143  
nsamples = 42, nedges = 148  
nsamples = 43, nedges = 151  
nsamples = 44, nedges = 156  
nsamples = 45, nedges = 160  
nsamples = 46, nedges = 163  
nsamples = 47, nedges = 167  
nsamples = 48, nedges = 172  
nsamples = 49, nedges = 176  
nsamples = 50, nedges = 180  
nsamples = 51, nedges = 182  
nsamples = 52, nedges = 186  
nsamples = 53, nedges = 191  
nsamples = 54, nedges = 196  
nsamples = 55, nedges = 201  
nsamples = 56, nedges = 203  
nsamples = 57, nedges = 208  
nsamples = 58, nedges = 211  
nsamples = 59, nedges = 215  
nsamples = 60, nedges = 220  
nsamples = 61, nedges = 224  
nsamples = 62, nedges = 228  
nsamples = 63, nedges = 233  
nsamples = 64, nedges = 238  
nsamples = 65, nedges = 241  
nsamples = 66, nedges = 245  
nsamples = 67, nedges = 250  
nsamples = 68, nedges = 255  
nsamples = 69, nedges = 257  
nsamples = 70, nedges = 259  
nsamples = 71, nedges = 261  
nsamples = 72, nedges = 264  
nsamples = 73, nedges = 268  
nsamples = 74, nedges = 272  
nsamples = 75, nedges = 277  
nsamples = 76, nedges = 282  
nsamples = 77, nedges = 287  
nsamples = 78, nedges = 291  
nsamples = 79, nedges = 295  
nsamples = 80, nedges = 299  
nsamples = 81, nedges = 304  
nsamples = 82, nedges = 309  
nsamples = 83, nedges = 312  
nsamples = 84, nedges = 317  
nsamples = 85, nedges = 322  
nsamples = 86, nedges = 325  
nsamples = 87, nedges = 328  
nsamples = 88, nedges = 333  
nsamples = 89, nedges = 338

nsamples = 90, nedges = 343  
nsamples = 91, nedges = 346  
nsamples = 92, nedges = 350  
nsamples = 93, nedges = 354  
nsamples = 94, nedges = 359  
nsamples = 95, nedges = 364  
nsamples = 96, nedges = 369  
nsamples = 97, nedges = 374  
nsamples = 98, nedges = 378  
nsamples = 99, nedges = 383  
nsamples = 100, nedges = 388  
nsamples = 101, nedges = 392  
nsamples = 102, nedges = 395  
nsamples = 103, nedges = 398  
nsamples = 104, nedges = 400  
nsamples = 105, nedges = 403  
nsamples = 106, nedges = 406  
nsamples = 107, nedges = 411  
nsamples = 108, nedges = 416  
nsamples = 109, nedges = 418  
nsamples = 110, nedges = 423  
nsamples = 111, nedges = 428  
nsamples = 112, nedges = 432  
nsamples = 113, nedges = 437  
nsamples = 114, nedges = 442  
nsamples = 115, nedges = 443  
nsamples = 116, nedges = 448  
nsamples = 117, nedges = 453  
nsamples = 118, nedges = 458  
nsamples = 119, nedges = 461  
nsamples = 120, nedges = 462  
nsamples = 121, nedges = 464  
nsamples = 122, nedges = 469  
nsamples = 123, nedges = 474  
nsamples = 124, nedges = 478  
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nsamples = 126, nedges = 486  
nsamples = 127, nedges = 487  
nsamples = 128, nedges = 492  
nsamples = 129, nedges = 497  
nsamples = 130, nedges = 502  
nsamples = 131, nedges = 505  
nsamples = 132, nedges = 510  
nsamples = 133, nedges = 512  
nsamples = 134, nedges = 517  
nsamples = 135, nedges = 522  
nsamples = 136, nedges = 524  
nsamples = 137, nedges = 528  
nsamples = 138, nedges = 532  
nsamples = 139, nedges = 537  
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nsamples = 141, nedges = 545  
nsamples = 142, nedges = 550  
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nsamples = 147, nedges = 569  
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nsamples = 149, nedges = 578  
nsamples = 150, nedges = 579  
nsamples = 151, nedges = 584  
nsamples = 152, nedges = 589  
nsamples = 153, nedges = 590

```

nsamples = 154, nedges = 595
nsamples = 155, nedges = 600
nsamples = 156, nedges = 605
nsamples = 157, nedges = 608
nsamples = 158, nedges = 611
nsamples = 159, nedges = 615
nsamples = 160, nedges = 616
nsamples = 161, nedges = 619
nsamples = 162, nedges = 624
nsamples = 163, nedges = 629
nsamples = 164, nedges = 630
nsamples = 165, nedges = 632
nsamples = 166, nedges = 636
nsamples = 167, nedges = 640
nsamples = 168, nedges = 644
nsamples = 169, nedges = 649
nsamples = 170, nedges = 654
nsamples = 171, nedges = 659
nsamples = 172, nedges = 664
nsamples = 173, nedges = 666
nsamples = 174, nedges = 670
nsamples = 175, nedges = 675
nsamples = 176, nedges = 678
nsamples = 177, nedges = 680
nsamples = 178, nedges = 682
nsamples = 179, nedges = 685
nsamples = 180, nedges = 687
nsamples = 181, nedges = 692
nsamples = 182, nedges = 697
nsamples = 183, nedges = 700
nsamples = 184, nedges = 704
nsamples = 185, nedges = 709
nsamples = 186, nedges = 714
nsamples = 187, nedges = 719
nsamples = 188, nedges = 723
nsamples = 189, nedges = 728
nsamples = 190, nedges = 733
nsamples = 191, nedges = 736
nsamples = 192, nedges = 741
nsamples = 193, nedges = 745
nsamples = 194, nedges = 749
nsamples = 195, nedges = 753
nsamples = 196, nedges = 757
nsamples = 197, nedges = 761
nsamples = 198, nedges = 766
nsamples = 199, nedges = 769
nsamples = 200, nedges = 770

```

## Add Nodes

```

roadmap2 = AddNode2PRM ([240 120 240 120 240 60]', roadmap, @DistSixLink, @(x,y)(LocalPlannerS
roadmap2 = AddNode2PRM ([0 0 0 0 0 180]', roadmap2, @DistSixLink, @(x,y)(LocalPlannerSixLink(x,

```

## Plan a Route

```

route = ShortestPathDijkstra(roadmap2.edges, roadmap2.edge_lengths, nsamples+1, nsamples+2);

```

## Plot the Trajectory

```

for i = 2:length(route)

```

```

x1 = roadmap2.samples(:,route(i-1));
x2 = roadmap2.samples(:,route(i));

delta = x2 - x1;

t = delta > 180;
delta(t) = delta(t) - 360;

t = delta < -180;
delta(t) = delta(t) + 360;

n = ceil(sum(abs(delta)) / 10);

for j = 0:n
    x = mod(x1 + (j/n)*delta, 360);
    fv = SixLinkRobot (x);
    p.Vertices = fv.vertices;

    drawnow;
    pause(0.01);

    if (CollisionCheck(fv, obstacle))
        fprintf (1, 'Ouch\n');
    end
end
end

```

