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```

% Horizon
dt = 0.01;

m = 0.5;
g = 9.81;
Qbas = 1;
% Weight in Final State:
Q = diag([0.005, 0.005, 0.005, 1, 1, 1, 1,1,1, 200,200,200, Qbas]);
Q_f = 1*eye(13,13);
Q_f(1,1) = 800;
Q_f(2,2) = 800;
Q_f(3,3) = 800;
Q_f(4,4) = 10;
Q_f(5,5) = 10;
Q_f(6,6) = 10;
Q_f(7,7) = 0.00000001;
Q_f(8,8) = 0.00000001;
Q_f(9,9) = 0.00000001;
Q_f(10,10) = 0.000000001;
Q_f(11,11) = 0.000000001;
Q_f(12,12) = 0.000000001;
Q_f(13,13) = Qbas;
% Weight in the Control:
R = 0.000005*eye(4,4);

% Initial Configuration:
xo = zeros(13,1);
xo(1,1) = -3;
xo(2,1) = -2;
xo(3,1) = -1;
uo = m*g*ones(4,1)/4;

% Target:
p_target = zeros(13,1);
p_target(1,1) = 5;
p_target(2,1) = 3;
p_target(3,1) = 2;

% Obstacle Equations
h1_0 = (0-2.2)^2 + (0-2.2)^2 + (0-1)^2 - 1;
hx1_0 = [2*(0-2.2), 2*(0-2.2), 2*(0-1), 0, 0, 0, 0, 0, 0, 0, 0, 0, 0];

h2_0 = (0)^2 + (0+0.2)^2 + (0)^2 - 1;
hx2_0 = [2*0, 2*(0+0.2), 2*0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0];

h3_0 = (0-3)^2 + (0)^2 + (0-0.5)^2 - 1;
hx3_0 = [2*(0-3), 2*0, 2*(0-0.5), 0, 0, 0, 0, 0, 0, 0, 0, 0, 0];

h_0 = [h1_0, h2_0, h3_0];

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## MPC code

```
Horizon = 8/dt;
gamma = 1;
[x_ddp, u_ddp] = calcDDP(xo, uo, p_target, Q_f, Q, R, Horizon, dt, h_0, hx1_0,
    hx2_0, hx3_0, gamma);

DDP Iteration 1, Current Cost = 1.400797e+07
DDP Iteration 2, Current Cost = 1.476072e+02
DDP Iteration 3, Current Cost = 3.776995e+04
DDP Iteration 4, Current Cost = 3.419292e+05
DDP Iteration 5, Current Cost = 1.565776e+05
DDP Iteration 6, Current Cost = 1.095109e+04
DDP Iteration 7, Current Cost = 2.312077e+02
DDP Iteration 8, Current Cost = 9.238340e+03
DDP Iteration 9, Current Cost = 1.678988e+03
DDP Iteration 10, Current Cost = 1.212973e+02
DDP Iteration 11, Current Cost = 1.262976e+02
DDP Iteration 12, Current Cost = 3.516692e+02
DDP Iteration 13, Current Cost = 3.127734e+02
DDP Iteration 14, Current Cost = 1.125515e+02
DDP Iteration 15, Current Cost = 1.243392e+02
DDP Iteration 16, Current Cost = 1.489925e+02
DDP Iteration 17, Current Cost = 1.315110e+02
DDP Iteration 18, Current Cost = 1.259938e+02
DDP Iteration 19, Current Cost = 1.108484e+02
DDP Iteration 20, Current Cost = 1.253427e+02
```

## Plotting the Result

```
time(1)=0;
for i= 2:Horizon
    time(i) =time(i-1) + dt;
end
% quadrotor_visualize_w_obstacles(x_ddp, u_ddp, time);

disp(x_ddp(1:6,end));
% figure(1);
% u_traj = u_ddp;
% obsplot(x_ddp);
% figure(2);
%plot(time, x_ddp(6,:))
% x_traj = x_ddp;
% quadplot

    4.9369
    2.9964
    1.9960
    0.5341
    0.3284
   -0.3077
```

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*Published with MATLAB® R2021b*