Contents

HW 3, Problem 2

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```
clear all;
clc;
```

Declare Constants

```
r                = 0.05;    % wheel radius
l                = 0.05;  % half the vehicle wheelbase


Zeta_I             = [0;0;0];              % X,Y,Theta of robot position in global coo
rdinates
GoalPos            = [10;0;0];                % X,Y,Theta of Goal
ObstaclePos        = [5;0;0.5];               % X,Y,Radius of Obstacle

rForce          = 1; % Repulsive Force of the obstacle
aForce          = 0.1; % Attractive Force

Field           = zeros(3,1); % Total Potential Field( x-dir, y-dir, angle )
aField          = zeros(2,1); % Attractive field due to goal
rField          = zeros(2,1); % Repulsive field due to obstacle

timeDiv = 0.1;

wSpeeds=[0;0];          %Left and Right Wheel speeds
```

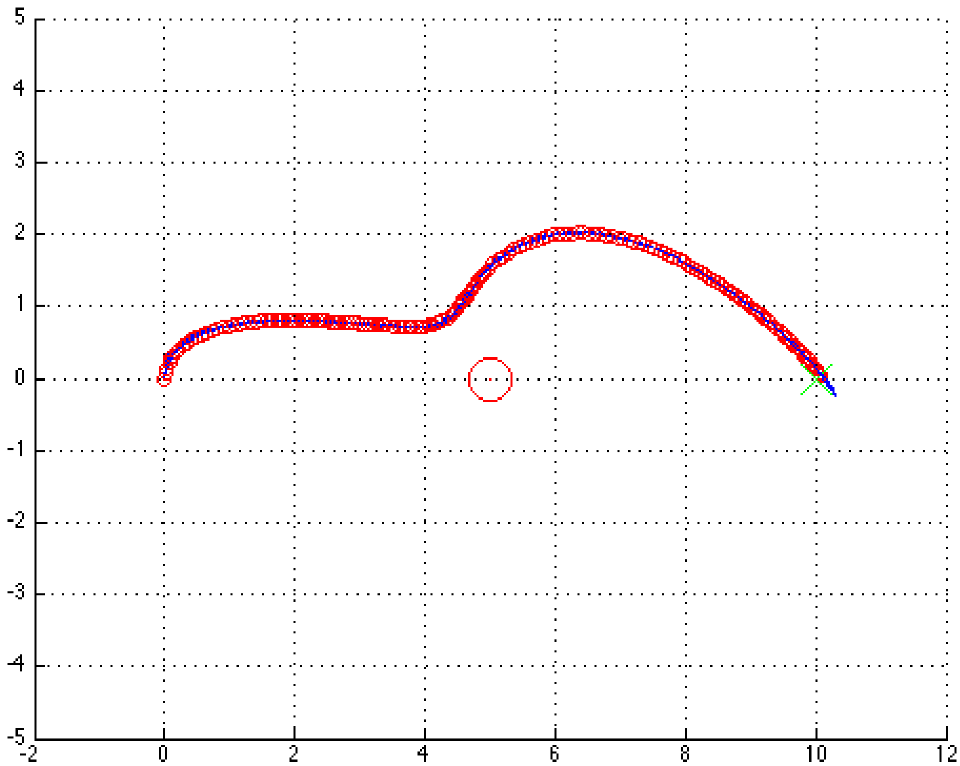
Run through six different scenarios where the wheel velocities vary.

```
figure;
while 1
        aField      = aForce*((GoalPos(1:2)-Zeta_I(1:2)));

        p_q         = norm(ObstaclePos(1:2)-Zeta_I(1:2));
        if p_q~=0
          rField    = -rForce*((1/p_q))*(1/(p_q*p_q))*((ObstaclePos(1:2)-Zeta_I(1:2))
/p_q);
        end

        Field(1:2)=aField+rField;

        if( atan(rField(2)/rField(1)) - Zeta_I(3) == 0 )
            Zeta_I(3) = pi/2;
        end

        if Field(1)==0 && Field(2)== 0
            Field(3)=0;
        elseif Field(1)==0
```

```
            Field(3)=pi/2;
        elseif Field(2)==0
            Field(3)=0;
        else
            Field(3)=atan(Field(2)/Field(1));
            if Field(1)<0&&Field(2)<0
                Field(3)=(pi)+Field(3);
            elseif Field(1)<0&&Field(2)>0
                Field(3)=(pi)+Field(3);
            end
        end

        Zeta_I_dot=[Field(1);Field(2);Field(3)-Zeta_I(3)];

        R_theta = [cos(Zeta_I(3)),sin(Zeta_I(3)),0;-sin(Zeta_I(3)),cos(Zeta_I(3)),0;0
,0,1];

        Zeta_L_dot = R_theta * Zeta_I_dot;

        %Now to solve the set of equations to find the wheel speeds
        B=[Zeta_L_dot(1);Zeta_L_dot(3)];
        A=[ r/2,      r/2;
            r/(2*l), -r/(2*l)
           ];

        wSpeeds=A\B;
        hold1 = GoalPos(1) - Zeta_I(1);
        hold2 = GoalPos(2) - Zeta_I(2);
        if (wSpeeds(1) < 10 && wSpeeds(2) < 10 && hold1 ~= 0 && hold2 ~= 0)
                wSpeeds(1) = wSpeeds(1) + 10;
                wSpeeds(2) = wSpeeds(2) + 10;
        end
        R_inv_theta = [cos(Zeta_I(3)),-sin(Zeta_I(3)),0;sin(Zeta_I(3)),cos(Zeta_I(3))
,0;0,0,1];

        % Velocity matrix
        Zeta_I_dot      = R_inv_theta * [ (r * wSpeeds(1))/2 + (r * wSpeeds(2))/2;
                                           0;
                                          (r * wSpeeds(1))/(2*l) - (r * wSpeeds(2))/(2*l)
;
                                        ];

        Zeta_I=Zeta_I+(Zeta_I_dot*timeDiv);

        Zeta_I;
        hold on
        plot(Zeta_I(1),Zeta_I(2),'--ro');
        plot(5,0,'--ro','MarkerSize',20);
        plot(10,0,'--gx','MarkerSize',20);
        grid on;
        axis([-2 12 -5 5]);
        %quiver(Zeta_I(1),Zeta_I(2),Field(1),Field(2));
        quiver(Zeta_I(1),Zeta_I(2),(0.4*cos(Zeta_I(3))),(0.4*sin(Zeta_I(3))));
        drawnow
        hold off

        GoalPos;
        Zeta_I(3);
        myposition = [ Zeta_I(1), Zeta_I(2) ];
        goalposition = [GoalPos(1), GoalPos(2)];
        distance = norm(goalposition - myposition);
        if( distance < 0.1)
```

```
            break;
        end
end

str=sprintf('We have arrived at your destination. Thank you for flying HAL 9000 Airli
nes.\nThe Sentients will have your luggage waiting for you at the terminal.\n');
disp(str);
```

```
We have arrived at your destination. Thank you for flying HAL 9000 Airlines.
The Sentients will have your luggage waiting for you at the terminal.
```



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