UNIVERSITY of HOUSTON | ECE

ECE 5397/6397: Intro to Robotics
HW 6, Due May 2, 11:59 pm Path planning

The path-planning method called Artificial Potential Fields uses gradient descent search to find a collision-free path to a goal configuration.

We provide the function PotentialFieldNavigation.m at
https://github.com/UH-ECE6397/Assignments/blob/master/PotentialFieldNavigation.m

```
% A path planner for an n-link planar robot arm moving among polygonal obstacles.
%
% Based off chapter 5.2 in "Robot Modeling and Control" by Spong, Hutchinson,
% and Vidyasagar
%
% Aaron T Becker, 04-13-2016, atbecker@uh.edu
%
```

Task 1 (5pts) repulsion from point obstacle: There are point obstacles that represent cutting lasers which must be avoided. Implement the function

```
function Fvec =  frepPt(q, pObstacle, eta, rhoNot)
    %computes the forces that repel each DH frame origin from a point
    %at positon pObstacle, given by equation 5.6 & 5.7 in RD&C
    %q: configuration of the arm
    %pObstacle: xy position of the point obstacle
    %eta: vector parameter that scales the forces for each degree-of-freedom
    %rhoNot: vector that defines the distance of influence of the obstacle
```

Task 2 (Graduate students 5pts, Undergrads, 5pts E.C.): add a set of floating repulsive control points (one per link)

```
function Fvec =  frepFloatingPt(q, pObstacle, eta, rhoNot)
    % computes the forces that repel a point on the link that is closest to any workspace obstacle
    % at positon pObstacle, given by equation 5.6 & 5.7 in RD&C
    % q: configuration of the arm
    % pObstacle: xy position of the point obstacle
    % eta: vector parameter that scales the forces for each degree-of-freedom
    % rhoNot: vector that defines the distance of influence of the obstacle
```

Task 3 (5pts) detect a local minimum: using the code on page 181, check if the movments for last three iterations are all less than **epsilon_min**. If so, set variable **inLocalMinimum** to be true.

Find a value of **epsilon_min** that will detect if the robot is stuck

epsilon_min = _____

Task 4 (5pts) random walk: if **inLocalMinimum** , then perform a random walk (page 181). Select a **t** value that works well, given the value v that specifies the maximum size of each step.

```
t = 5;  %how many random steps to take?
v = pi/10; % maximum random value at each step
```

Task 5 (5pts E.C.) polygonal obstacles: Change the lasers to exploding polygonal containers of dynamite that must be avoided. Change frepFloatingPt(q, pObstacle, eta, rhoNot) to compute the closest point on the polygonal obstacle.

Dr Becker will generate polygonal obstacles..