CS3105 AI Robotics Practical 1 Notes

Main code location:
Potentialfields.java

Theory and Design

Always remember to build on success by varying one factor at a time.
Aim to *gradually* increase completeness.

What is fractional progress?
Fractional progress may be defined to be a decrease of the fraction *f/(p+f)* or equivalently an increase of the fraction *p/(p+f)* where *p* is the past up to the end of the candidate next transition and *f* is the estimated future.

Suggestion for *p*: 1st arc length to sample point.
Suggestion for *f*: 3-arc length total + obstacle potential.

Potential counter-example: *p* increasing without *f* decreasing as much, e.g. spiral. Test your definitions of *p* and *f* and your methodology conceptually or empirically against the counter-example to make sure they are likely to work.

Think about whether it is best to reset fractional progress to be measured from the current position at each stage or to keep it from the initial position.

How do Winding and Unwinding combine?
Suggestions:
1. Use a lowish obstacle potential threshold to determine when a sample point is *viable*, i.e. leads to sensible navigation, and when it should be rejected.

So when the threshold is breached by a sample point, reject the point as non-viable. This should stop the transitions taken from getting too close to the obstacle edge.

2. If there is at least one viable Unwinding sample point, then take the Unwinding point that makes maximum fractional progress. [Is your maximum optimal in some clear sense?]

3. If there is no viable Unwinding sample point, but there is a viable Winding point, then take the Winding point that makes maximum fractional progress. [Is your maximum optimal in some clear sense?]

4. If there are no viable sample points, take the one that makes the most fractional progress.

Be aware that how you Unwind can be optimised - your 1st version may need refining in some way for the trickier obstacles.

Path Deformation

There is no need to be worried about estimated future paths going through obstacle boundaries beyond any current boundary. The path can be deformed to bend round new boundaries as they are sensed and traversed.

Some (but not necessarily all) aspects to think about

1. A winding variable for how much winding has gone on in the past.
2. An update function for how much winding has gone on in the past.
3. When should the Unwinding be stopped?
4. What is a safe distance from the nearest obstacle to say the robot is in Free Space?
5. Should the radius of the forwards sample point semi-circle change as the goal is neared?