

Navigation: Potential fields

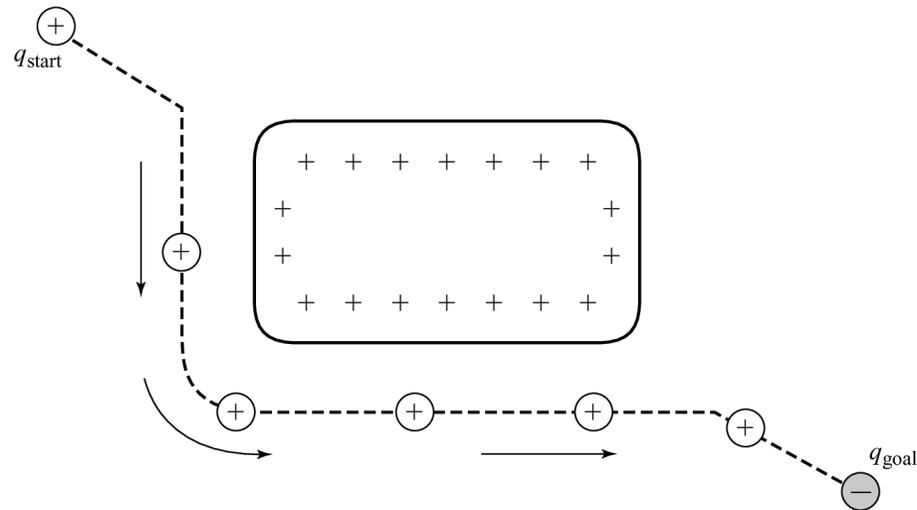
Introduction and algorithm

Introduction

Definition

Potential fields solve the navigation problem by modeling the robot as a particle responding to an attractive force from its goal and repulsive forces from obstacles.

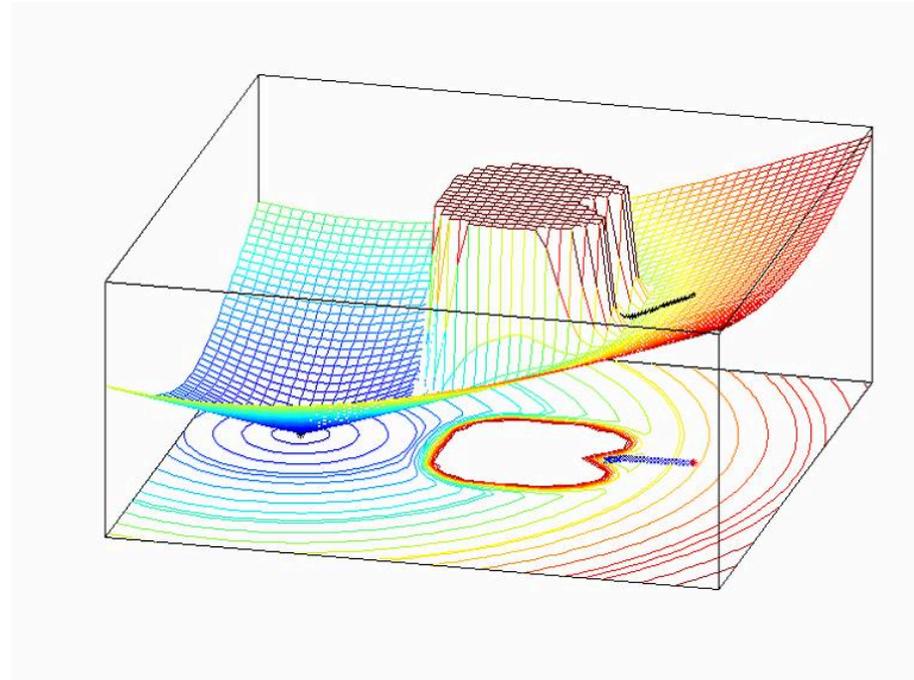
The intuition is that a **potential function** defines a landscape along which the robot moves “downhill”.



Potential functions

A **potential function** is a function $U : X \rightarrow \mathbb{R}$.

- Input: A state x .
- Output: The potential $U(x)$ at state x .



Moving in the potential field

The robot's motion follows the negative gradient of the potential function.

$$-\nabla U(x, y) = - \begin{pmatrix} \partial U / \partial x \\ \partial U / \partial y \end{pmatrix}$$

Intuition: Always move in the steepest direction downhill.

This forms a **vector field**, in which each state is associated with a vector showing the direction the robot should move from that state.