Motion Planning Terminology List
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Some terms in motion planning based on [1], [2], and [3]:

Configuration (q) The complete, internal, specification of the machine. Notice that this does not specify where the machine is or what the boundary and initial constraints are relative to the environment.

Configuration-space ($\mathcal{C}$-space or Q) The space made up of all possible configurations. In a mechanism, for example, this is the joint-space in which each degree of freedom can be thought of as a parameter. In a hinged door, for example, the $\mathcal{C}$-space is the angle defined between the door and the wall (i.e., ($\mathbb{S}^1$) (or a unit circle)).

Free configuration-space ($Q_{\mathbf{free}}$) The set of possible configurations that will not intersect an obstacle in the workspace (i.e., we define $Q(O_i)$ as the configuration mapping $W(O_i)$, hence $Q_{free} = Q - (\sum Q(W(O_i)))$).

Map Any representation from an initial to a final position. Various types including geometric, grids, and topological

Motion planning Finding feasible trajectories, typically expressed single rigid-body machine velocities

Sampling-based motion planning A strategy that casts to motion planning problem as a sample-based search (as opposed to an optimal control problem - see ch. 8 of [1]). The idea is to search to find the roadmap trajectory and to take advantage of the fast computation of collision-checking and speed of forward testing of configurations (in the **free configuration-space**). The mechanism works by constructing a roadmap from various sampled positions to other sampled positions and then solves queries by searching the roadmap (graph). It has three critical bits: (1) a distance metric in the configuration space (i.e., a means for determining the "cost" or "distance" between two given configurations, which could be as simple as a straight line in $\mathcal{C}$-space or quite complicated given the mechanics, such as non-holonomic car-like machines); (2) the local planner is a mechanism to solve for a valid drivable motion between two nearby configurations in the free $\mathcal{C}$-space ; and (3) a query or motion solving mechanism that uses the generated roadmap to give motion solution to requested problems and that reduces the motion roadmap (e.g., via a greedy approach).

Control-based motion planning Extension of motion planning beyond finding achievable sets of velocities to factor actuator driving to allow for smooth and mechanically preferable motions that factor actuator saturation, actuator jerk/impulse, and vibration.

Path A continuous curve in configuration space

Path planning Finding a curve between two positions in $\mathcal{C}$-space , often against various optimization criteria (such as time, energy, etc.)

Roadmap A topological map (similar to those used with graphical models) in which each location is a node and the path between them is an edge

Trajectory A path parameterized by time

Workspace (W) The ambient environment (or space) in which the machine operates in. Typically a planar ($\mathbb{R}^2$) or 3-D ($\mathbb{R}^3$) Cartesian representation, though other metrics are relevant and valid such as WGS-84 (an ellipsoid used in GPS). This can be considered as a "world" view.

Free Workspace ($W_{\mathbf{free}}$) The subset of the Workspace without obstacles (i.e., given obstacles (O_i) and their particular workspace locations ($W(O_i)$), $W_{free} = W - (\sum W(O_i))$.

References

[1] R. M. Murray, Z. Li, and S. Sastry. *A Mathematical Introduction to Robotic Manipulation*. CRC Press, Boca Raton, FL, 1994.

[2] H. Choset, K. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. Kavraki, and S. Thrun. *Principles of Robot Motion*. MIT Press, 2005.

[3] S. M. LaValle. *Planning Algorithms*. Cambridge University Press, Cambridge, U.K., 2006.