# Minimalist Motion Planning Using Global Topological Guarantees

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## The Planner Today

Overly precise.

Despite many valid motion plans for any given problem, traditional motion planners provide one precise trajectory.

Committing to a specific path runs the risk of the path becoming infeasible before it can even be executed by the robot.



The Traditional Pipeline



#### Guarantees

- 1. Safety: The robot will navigate collision-free.
- 2. Correctness: The robot will get from the starting point to the goal point.
- 3. Completeness: If there exists a valid path for the robot to get from the starting point to the goal point, the robot will find and take this path.

#### An Alternative

To evade the issues from an overly precise plan specification, we instead specify homotopy classes rather than trajectories.



#### **The Alternative Pipeline**

This alternative should provide the same guarantees\* as the planner today by grouping steps.



#### **Research Questions**

1. How does the planner impose restrictions?

2. If loops around obstacles are to be considered, is it best done at the path specification stage?

3. How little sensing can we get away with for our map and still allow us to plan? What guarantees do we need from our map to be able to plan?

### Benefits



- Allows for the flexibility of a controller that can optimize and react in real time.
- 2. For human users, a homotopy class specification may align better with their desired behavior for the robot.
- 3. It may be possible to get away with less metric specificity, requiring less sensor input from the very beginning.