Background

- Robots must plan their movement in environments while ensuring that they will not collide with obstacles along their path.
- Humanoid and other robots often have many degrees of freedom, each of which is controlled independently, which means that a path must be planned in high-dimensional spaces.

Fundamental Questions/Challenges

- Complete motion planners can conclusively determine in finite time path existence and provide a path when it exists, but are difficult to implement and very slow (PSPACE-Hard).
- Sampling-based motion planners are effective in practice for path planning even in high-dimensional spaces, but lack stopping conditions when no path is found or none exists.
- Sampling-based planners have difficulty dealing with narrow tunnels: places where a robot has few choices of collision-free configurations.

Goals

- Determine a criterion to ask queries of path existence without finding a viable path; separate the two problems.
- Integrate the path existence query with existing sampling-based planner schemes to speed up planning in cases where no path exists.

Related Work/Interaction with Other Projects

  - Uses rectangular cells instead of a triangulation to partition the configuration space and provide path existence queries.