FFROB: AN EFFICIENT HEURISTIC FOR TASK AND MOTION PLANNING

Caelan Garrett, Tomas Lozano-Perez, and Leslie Kaelbling
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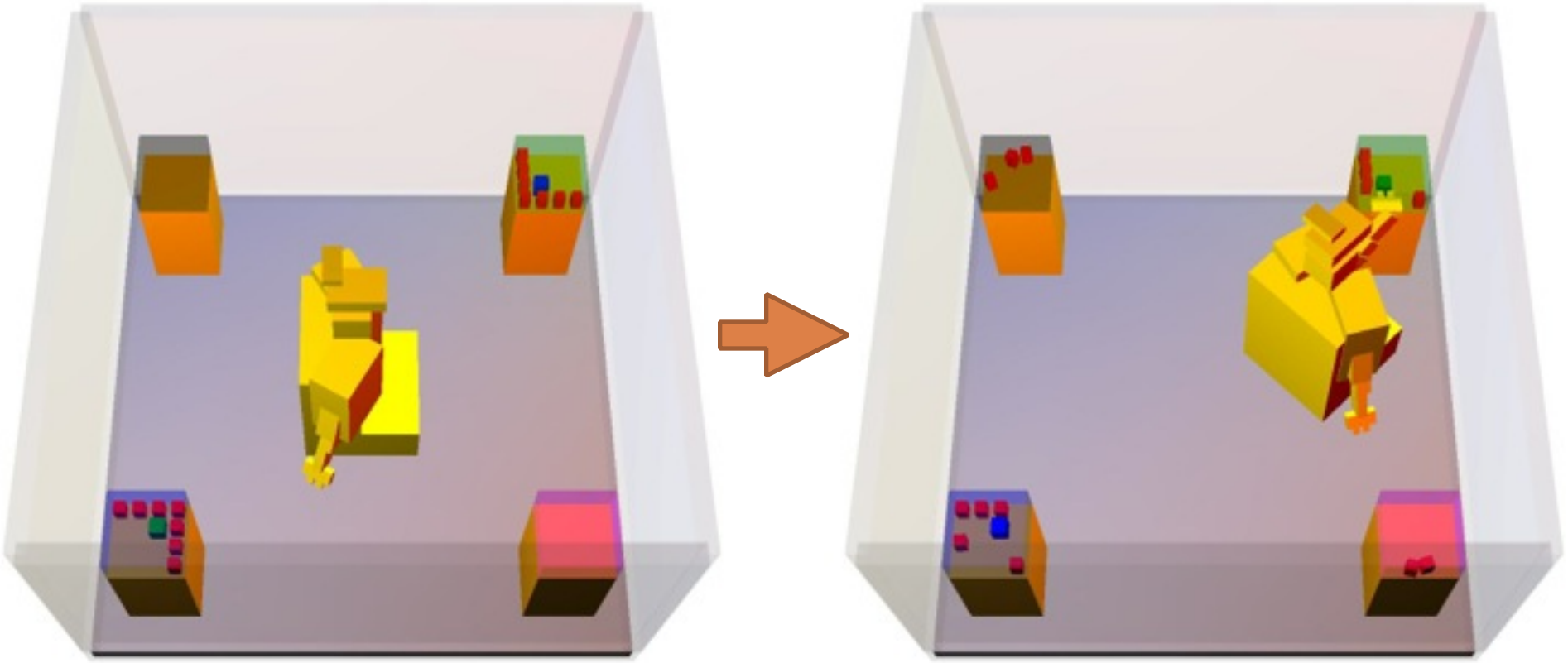
Swap Green and Blue Blocks



Multi-Step Manipulation Planning

- Classic **manipulation planning** focuses on single geometric operations, not long sequences.
- Classic **task planning** abstracts out most geometry, but can generate long sequences.
- Our goal is to combine their strengths.

Integrated Search Strategy

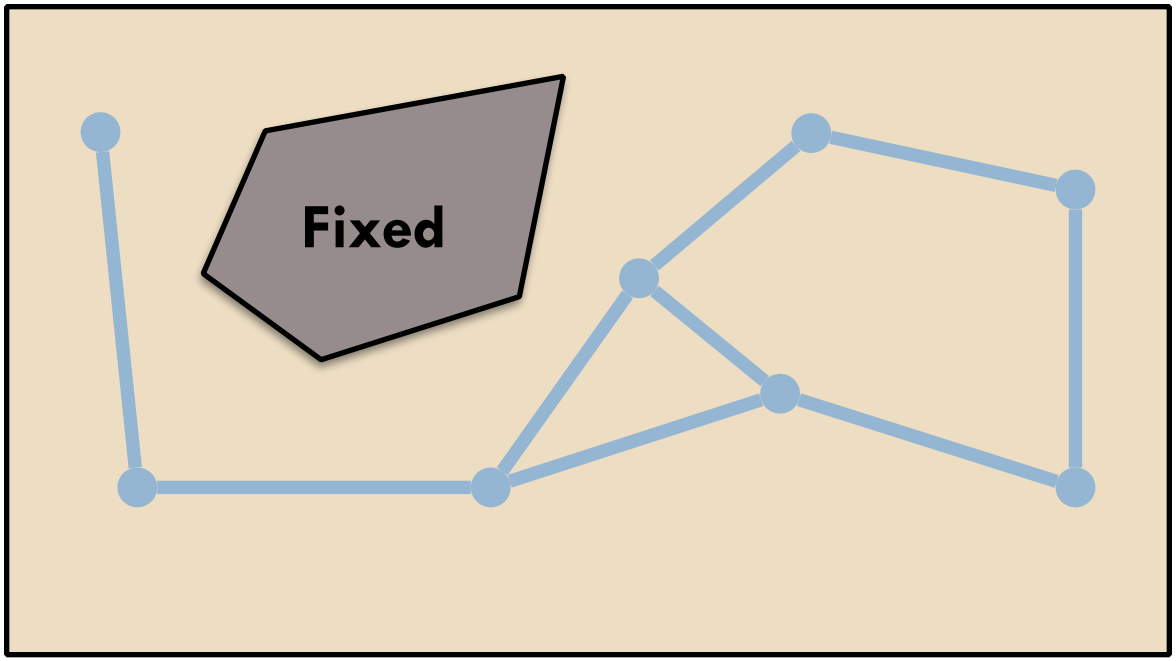
- Forward search guided by **heuristic** capturing both symbolic and geometric information

- Geometric information captured by **conditional roadmap** that depends on the configuration of moveable objects

Conditional Reachability Graph

- Similar to a PRM but with moveable obstacles

- Answers ***Reachable(C1,C2)*** queries for a state, conditional on object placements and grasp



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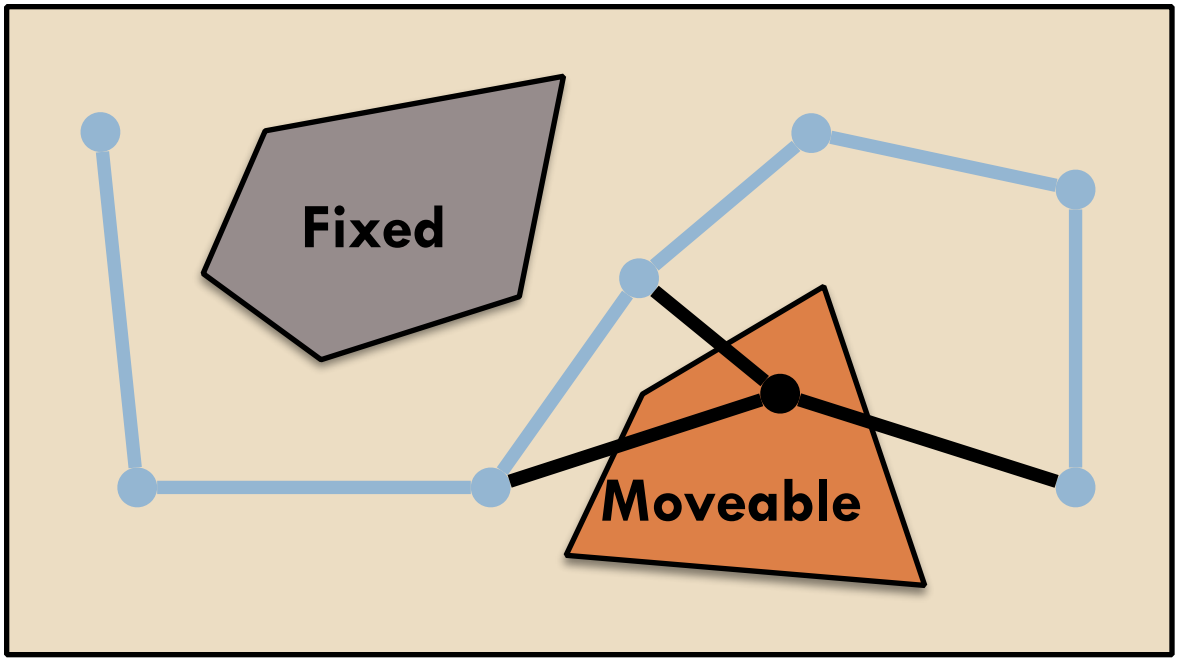

Integrated Search Strategy

Enables efficient solution of problems requiring many geometric operations

- CRG supports efficient computation of heuristic
- Heuristic significantly reduces effective task-level search space