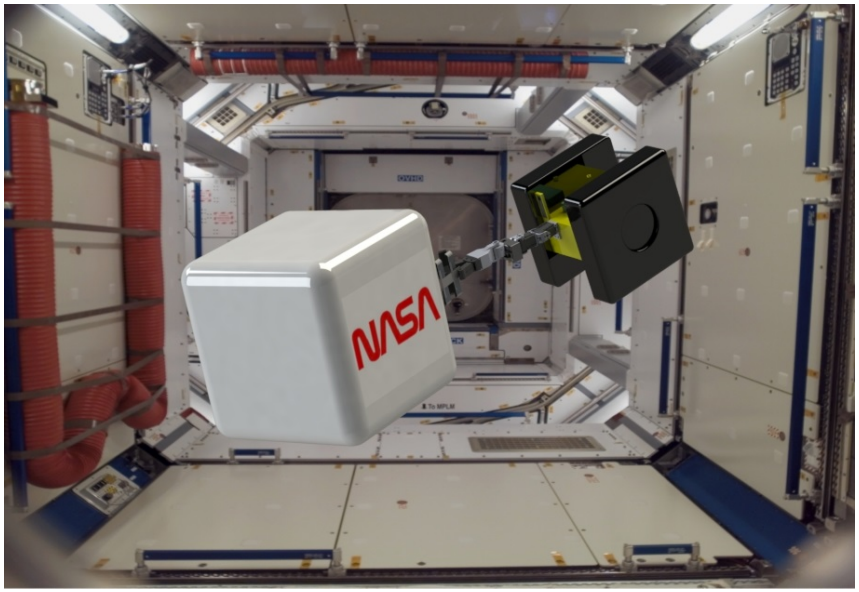
Convex Optimization-Based Approaches for Spacecraft Trajectory Optimization



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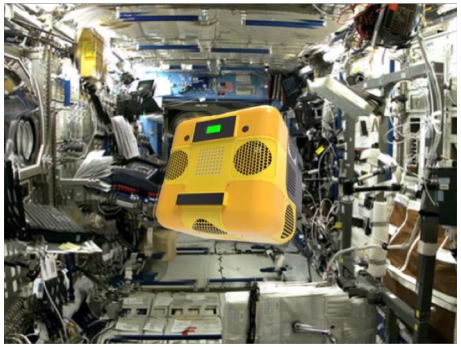
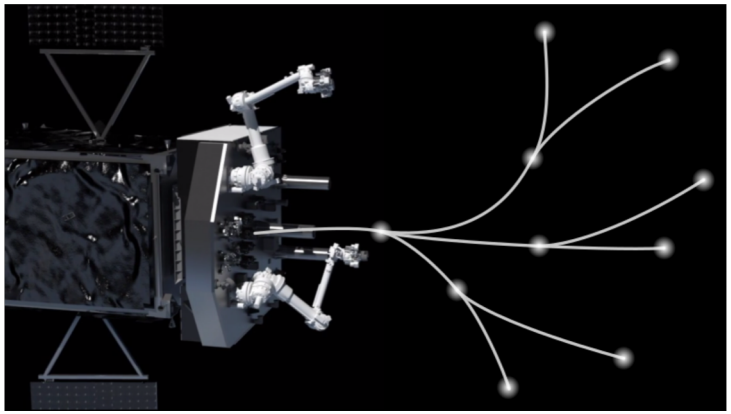
Motivating Goals

- Assistive free-flyers on the ISS
  - Perching for inspection/monitoring
  - Tool retrieval, return
  - Unpacking cargo



Astrobee

- Complex in-space manipulation and proximity operations tasks
  - On-orbit servicing, assembly
  - Debris removal
  - EVA assistance



Restore-L Servicer

Goal: Safe, autonomous navigation for robotic spacecraft

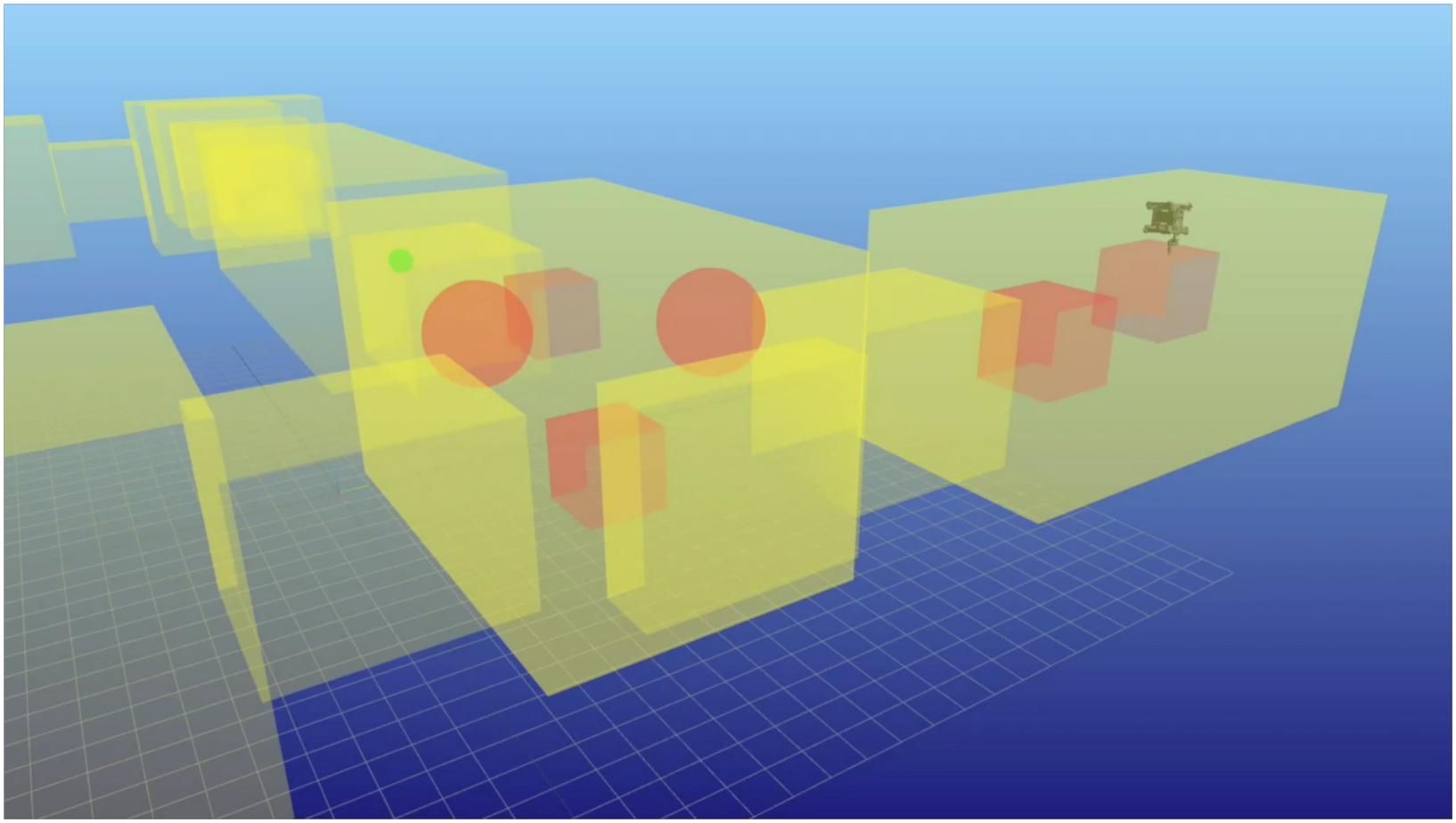
Sequential Convex Programming

- SCP has gained traction for trajectory optimization
  - Iterative method for solving non-convex optimization problems
  - Existing approaches lack guidance on how to solve problem in principled manner i.e. initialization strategies, convergence

- GuSTO is a new algorithmic framework
  - Provides convergence guarantees for dynamic feasibility, guides user for different initialization strategies
  - Handles a broad class of problems using an optimal control approach: free final-time, goal region constraints on manifolds
  - Informed use of direct and indirect methods to accelerate SCP

[Bonalli, Cauligi, Bylard, and Pavone, ICRA ’19 (submitted)]

Results



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