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Title: Model-Based Robust Mobile Manipulation

Abstract: Robotic manipulation of objects in unstructured environments, i.e., “the real world” is further complicated by introducing mobility. The greater uncertainty of reference frames, unknown constraints, and real-world phenomena such as objects being stuck or atypically constructed may result in unforeseen scenarios that are more difficult than classical structured and stationary robotic manipulation problems. Utilization of primitive mechanical models of possible interactable objects and robust control methods can improve the robustness of mobile robots interacting with the real world. For example, to open a door, a 1DOF model can be deduced that results in a finite set of interaction scenarios. A primitive model can be used for online trajectory generation and impedance parameter tuning, so that robot components or objects/structures don’t mechanically fail and the manipulation task goals are more likely to succeed. This work implements a sliding mode impedance control law on a 7R serial robot and a 2 finger gripper, with the robot arm attached to a two body tracked vehicle known as Gemini. Early experimental results show this framework for manipulation can successfully allow for mobile manipulation despite large discrepancies between the world and what the robot perceives.

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