

Assignment 09: Trapezoid Direct Collocation

Optimal Control for Robotics

Assigned: March 27 — Due: April 4 at 11:55pm

Introduction

In this assignment you will use the trapezoid method for direct collocation to compute the minimal-torque swing-up for a simple pendulum, and the minimal-thrust flip maneuver for a planar quadrotor model.

Implementation Details

Most of the code to implement these two optimizations is included in the assignment. You only need to implement two sub-functions within the file `dirColBvpTrap.m`. The first computes the objective function value and the second evaluates the nonlinear constraints. The `dirColBvpTrap()` function calls a few functions from the code library, so make sure that you've added that to your Matlab path before starting this assignment.

Your code must be written well, both for computational efficiency and readability.

- Your code should be fully vectorized: no for loops are allowed.
- Use the function `unpackDecVars` to obtain the state and control at the grid points. This makes the code more readable and avoids bugs relating to indexing into `decVars`.
- Make use of the data provided in the problem description struct: this prevents you needing to compute this information on every function call.

Coding Challenge

If you want a challenge, then start this assignment by deleting some or all parts of the template code, leaving only the function declaration and documentation (first 75 lines of code). If you choose this option, then please add a note to the function documentation, along with a description of how you organized your code. Your code should still follow the good coding practices described above, although you do not need to implement the specific sub-functions that are in the template.

Deliverables

Implement the function `dirColBvpTrap.m` using the template provided.