Assignment 10: Hermite–Simpson Direct Collocation

Optimal Control for Robotics

Assigned: April 6 — Due: April 13 at 11:55pm

Introduction

In this assignment you will use the Hermtie–Simpson 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

There are two formulations of the Hermite–Simpson direct collocation technique: separated and compressed. In the separated form, the state at the midpoint of each segment is a decision variable, while in the compressed form the state at each midpoint is explicitly computed on each iteration. For this assignment please use the separated form.

This asignment is intentionally very similar to HW 09, with the only difference being the collocation method. You to start with your solution for HW 09, and then modify it to use the Hermite–Simpson method instead of the trapezoid method. You may choose instead to start with the solution to HW 09, although you should make a note in the code that indicates this.

Hermite–Simpson direct collocation uses a cubic spline for the state and a quadratic spline for the control. I suggest that you use the spline utilities in the code library for the course to generate these splines, although you are welcome to use you own implementation if desired.

I've included the solution in p-code form so that you can check your implementation.

Deliverables

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