

Exercises: Getting started with acados in Python

Jonathan Frey, Prof. Dr. Moritz Diehl

This exercise showcases how to use acados with its Python interface.

Important Resources

- <https://docs.acados.org/>
- Installation guide <https://docs.acados.org/installation/>
- Python Interface: Installation and documentation https://docs.acados.org/python_interface/
- acados problem formulation PDF: https://github.com/acados/acados/blob/master/docs/problem_formulation/problem_formulation_ocp_mex.pdf
- acados forum <https://discourse.acados.org>

Exercises

A template for this exercise is given on the web page.

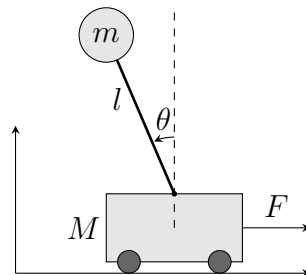


Figure 1: Schematic illustrating of the pendulum on a cart.

Model and MPC task

- We consider a pendulum on a cart model
- The goal is to stabilize the model in the upward position.
- The model is implemented in `pendulum_model.py`
- Run the `main.py` file to solve a single OCP with acados and plot the trajectories. The plot is shown in Figure 2. Get an overview on the implementation.

Closed loop simulation

- Modify the file to instead run a closed loop simulation `closed_loop_simulation()`. Here, an integrator of the type `AcadosSimSolver` is created based on the OCP formulation, i.e. the same integrator that is used to discretize the ODE between two subsequent shooting nodes.

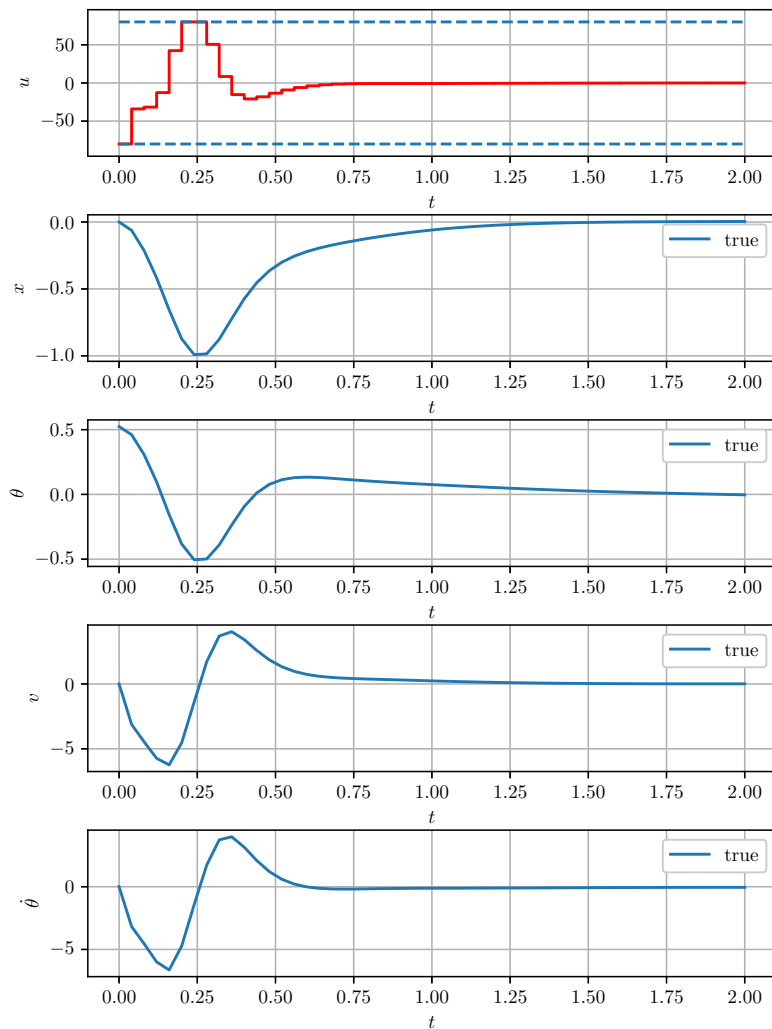


Figure 2: OCP solution, first exercise

Parametric model

- Modify the file `pendulum_model.py` to provide a parametric version and make the mass of the cart M a parameter by implementing the function `export_parametric_pendulum_ode_model()`
- Run the closed loop simulation using the parametric model
- Vary the mass of the cart only for the integrator by 20 % in the closed loop simulation.