MuJoCo: double pendulum (1)

Overview

1. Create a doublependulum model in xml
2. Check energy balance of a free pendulum
3. Check equations of motion
4. Torque-based position control using three methods
   i) position-derivative (PD) control
   ii) (gravity + coriolis forces) + PD control
   iii) feedback linearization control
5. Writing data file from MuJoCo and plotting in MATLAB

MuJoCo: double pendulum (2)

Using template_writeData.zip to get started

1. From tiny.cc/mujoco download template_writeData.zip and unzip in myproject
2. Rename folder template to dbpendulum
3. Rename pendulum.xml to doublependulum.xml
4. Make these three changes
    1. main.c — line 28, change template_writeData/ to dbpendulum/ and pendulum.xml to doublependulum.xml
    2. makefile — change ROOT = template_writeData to ROOT = dbpendulum also UNCOMMENT (remove #) appropriate to your OS
    3. run_unix / run_win.bat change <template_writeData> to <dbpendulum>
5. In the *shell, navigate to dbpendulum and type ./run_unix (unix) or run_win (windows); *shell = terminal for mac/linux and x64 (visual studio) for win

MuJoCo: double pendulum (3)

Main.c

1) Check energy

- mj_energyPos(m,d) & mj_energyVel(m,d);

MuJoCo: double pendulum (4)

Main.c

2) Check equations of motion: M qddot + C + G = tau

- M is mass matrix 2x2
- qddot is acceleration, 2 x 1
- C is coriolis forces, 2x1
- G is gravitational force, 2x1
- tau is external torque, 2x1

MuJoCo: double pendulum (5)

Main.c

2) Check equations of motion: M qddot + C + G = tau

MuJoCo equations of motion:

M qacc + qfrc_bias = qfrc_applied + ctrl

- qfrc_bias = C + G
- tau can be qfrc_applied OR ctrl
- qfrc_applied is always available (generalized force)
- ctrl is available on if an actuator is defined

MuJoCo: double pendulum (6)

Main.c

Equations: M qddot + f = tau where f = C + G

3) Controllers

i) Proportional-Derivative control

tau = -Kp*(q-q_ref) - Kd*qdot

ii) (gravity + coriolis forces) + PD control

tau = f -Kp*(q-q_ref) - Kd*qdot

iii) Feedback linearization

tau = M(-Kp*(q-q_ref) - Kd*qdot) + f