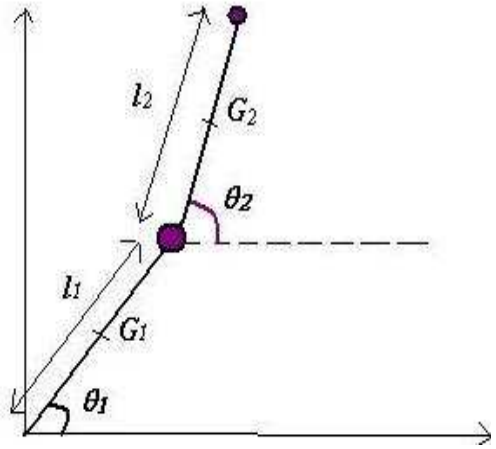
Pendubot

Midterm presentation

Description of the Pendubot

- One motor
- Two links
- Two encoders



Objectives with the project

- Stabilize in up-up and down-up
- Swing-up
- Peripheral movement
- Safety net

Modeling

- Lagrange method
- Energy based
- State-space
- Linearization

Control strategy

- Balancing control
- Swing-up control
- Safety net
- Switched system

Balancing control

- Linearize
- LQ approach
- State-feedback

Swing-up

- Partial feedback linearization
- PD-control
- How to choose reference?

Safety net

- Stop system when unsafe
- When unsafe?
- Freefall to bottom
- Catch with controller at the bottom

Switched system

- For peripheral movement
- Multiple sectors needed
- One controller per sector
- Final control system is hybrid automata

Implementation

- Labview with DAQ card
- Measure angles and map into interval
- Compute angular velocities
- Choose appropriate controller
- Calculate control signal
- Send out control signal to motor

Results so far

- Model done and validated
- Stabilizing controllers done
- Partial feedback linearization is working
- True system stabilized in different equilibria

Theoretical problems

- How to do handover between balancing sectors when using reference?
- How to tune PD-controllers etc. for swing-up?
- How to cross uncontrollable state?

Static error

- Static error due to imperfections in servo amplifier

Questions ?