Furuta Pendulum - Technical Report

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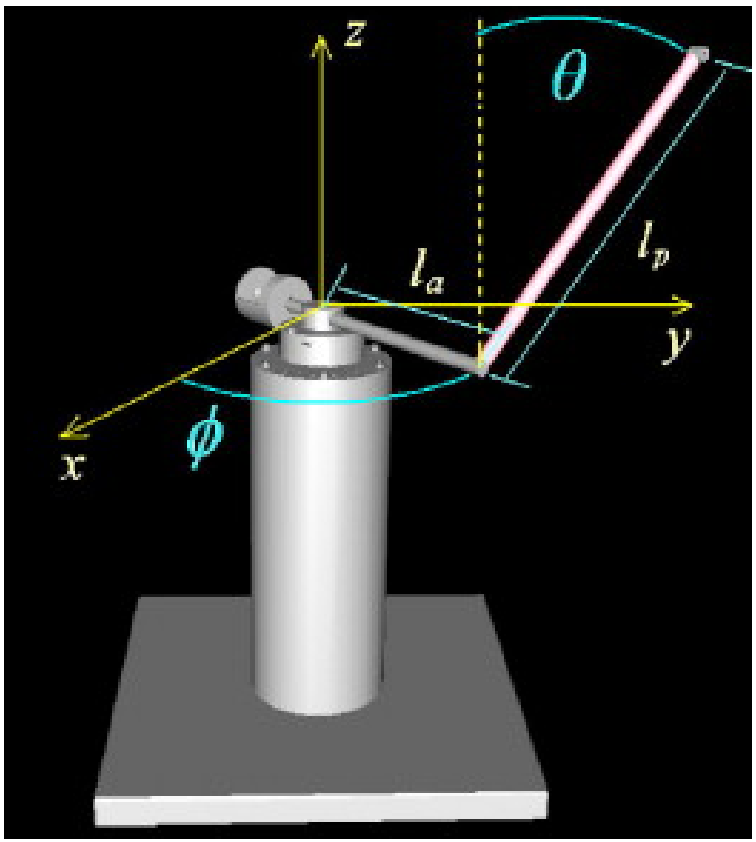
Introduction



La Hera u. a. (2009)

- Underactuated System (2 DOF, 1 actuator)
- Highly non-linear
- Two control problems
  - "swing-up"
  - "stabilization"

Swing-up & Stabilization

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Swing-up

- Energy control
- Decide whether to "push" or "pull"

Stabilization

- Proportional integral derivative (PID)
- Linear quadratic regulator (LQR)
- Particle swarm, evolutionary algorithms

Reinforcement Learning on the Furuta Pendulum

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- TD(λ), Kalman filter, Gaussian Process $\rightarrow$ no stabilization
- ANN with PID controller $\rightarrow$ only prediction
- Our implementations $\rightarrow$ seem to work well

Summary

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- Complex system
- Not yet that relevant in Reinforcement Learning

Can Reinforcement Learning improve results on the Furuta pendulum?

Sources

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[La Hera u. a. 2009] La Hera, Pedro X. ; Freidovich, Leonid B. ; Shiriaev, Anton S. ; Mettin, Uwe: New approach for swinging up the Furuta pendulum: Theory and experiments. In: *Mechatronics* 19 (2009), Nr. 8, S. 1240–1250