

Furuta Pendulum - Technical Report

Tabea Wilke

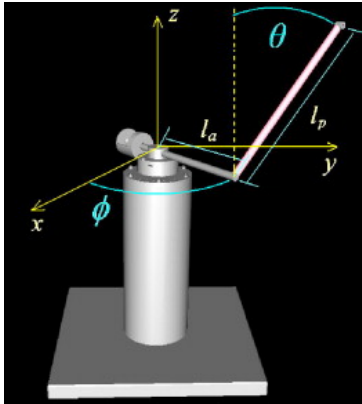
Yannik Frisch

Maximilian Gehrke

Group 19 Oleg Arenz



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La Hera u. a. (2009)

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

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



- ▶ Complex system
- ▶ Not yet that relevant in Reinforcement Learning

Can Reinforcement Learning improve results on the Furuta pendulum?



[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