



Aktorik und Sensorik mit intelligenten Materialsystemen 4

Computer Lecture: Nonlinear control of a SMA-spring actuator

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Computer Lecture Overview

- GOALS:
 - PI position control for a SMA-spring actuator
 - Implementation of sliding mode position control
 - Comparison among the two controllers



Assignment

- Given the Simulink file representing the SMA-spring model:
 - Design and implement a PI controller for the SMA actuator, based on the following linearized model,

$$G(s) = -\frac{0.2891}{s + 14.93}$$

in such a way that the closed loop system is a first order transfer function with time constant $\tau^* = 0.02$ s.

- Considering J bounded between 0 and 0.25 W, implement a sliding mode control architecture. Implement an arbitrary chattering-avoiding configuration, with ε chosen arbitrarily.
- Compare the performance of both controllers in tracking a sinusoidal reference as

$$r(t) = 0.103 + A \sin(2\pi ft)$$

where A and f are free parameters. Consider different values of f (e.g., 1 Hz, 3 Hz, 5 Hz) and A (e.g., 0.0005, 0.001, 0.0015), and see how the two controllers perform in both cases. NOTE: in case simulation time is too large, you can deactivate the computation of internal hysteresis loops via the variable **params_PC2.internal_loops_flag** in **Parameter_PC2.m** file