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System-on-Chip Design of a LQ-regulator with integrated Kalman-Filter.

ABSTRACT - Masterthesis

The following thesis documents the design and implementation of a digital control algorithm in a hardware-software co-system. Therefore, a linear-quadratic regulator and an adaptive Kalman-Filter (ROSE-Filter) are designed based on the physical model of the inverted pendulum on a cart. The resulting control system is then implemented as a combination of a custom hardware and a microblaze softcore processor.

Initially, the contemporary literature is reviewed to provide a theoretical background on statespace controllers and state observers. Based on the theory and a previous work, a controller architecture for the physical system of an inverted pendulum on a cart is designed and implemented in Matlab/Simulink. The structure as well as the simulation results of this reference model are then used to design a hardware-software co-system that implements the same functionality as the reference model. In the last step, a co-simulation between the implemented design and the reference model is performed to verify the correct function of the implemented system.