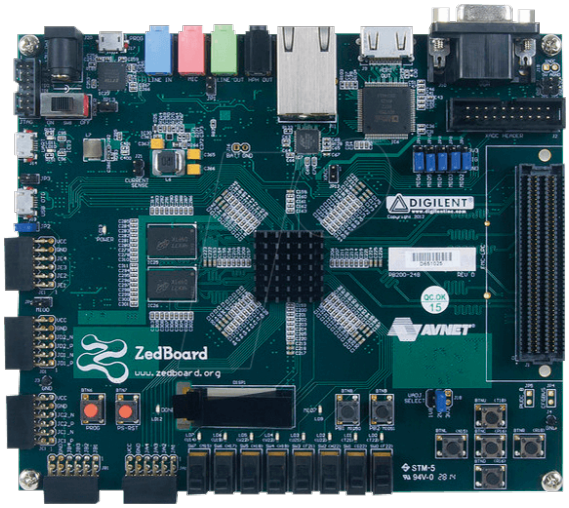
DyConPV

HiWi/Master's thesis:

„Embedded Real-Time Model Predictive Control on FPGA“

Model predictive control (MPC) is an advanced control technology which outperforms classical control in many aspects, e.g. MPC can deal with operational constraints without complicated tuning, and provides an optimal solution. Recent developments in algorithm and computational hardware allow applying MPC to real-time control of very fast dynamical systems. In the research project Highly Dynamic Control of Photovoltaic Inverters (DyConPV), we aim to design fast MPC controllers for power converters which are implemented on FPGA chips.



Possible topics:

- Develop the method to generate programs for linear algebra operations Matrix-Matrix and Matrix-Vector multiplications for FPGA.
- Design a multirate nonlinear MPC controller which computes a linear controller at a normal sampling rate, while taking advantage of FPGA to update the control at the faster rate.
- Implement an accelerated proximal gradient algorithm for linear MPC on FPGA.
- Parallelize operations in FPGA to accelerate linear MPC solution.

Requirements:

- Studying at a University or University of Applied Sciences
- Knowledge in fundamental control theory
- Good programming skills (C/VHDL)
- Experience in embedded hard- and software development (familiarity with FPGA is a plus)

Duration: 6 months for master thesis, can be combined with a HiWi

Supervisors: Prof. Moritz Diehl + Dr. Dang Doan

Work place: Systems Control and Optimization Lab – University of Freiburg, and Fraunhofer Institute for Solar Energy Systems ISE in Freiburg (for experiments).

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