

## Adaptive Digital Control and Self-Optimizing Calibration Architecture for Superconducting Qubit Systems

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<b>Project Type:</b>	Master Project	
<b>Location:</b>	Microcity, Neuchâtel	
<b>Start Date:</b>	Flexible	

### Description:

Superconducting qubit systems require continuous, precise calibration of a large parameter space spanning microwave control pulses, flux bias lines, readout resonators, and underlying hardware primitives such as phase-locked loop frequencies and direct digital synthesis memory modes. Manual calibration workflows are time-consuming, do not scale beyond a handful of qubits, and cannot track the slow drift of qubit parameters over experimental timescales. To solve these problems student is asked to take a part for the design of a fully digital, FPGA(or ASIC)-based control architecture that integrates a Direct Digital Synthesis (DDS)-based pulse generation engine with an autonomous calibration sequencer and an online learning algorithm. The system continuously optimizes qubit control fidelity while simultaneously minimizing hardware resource consumption through adaptive selection of DDS memory modes, PLL clock configurations, and calibration scheduling. The proposed architecture will validated against a superconducting transmon qubit system using a Zurich Instruments SHFQC as the readout backend.

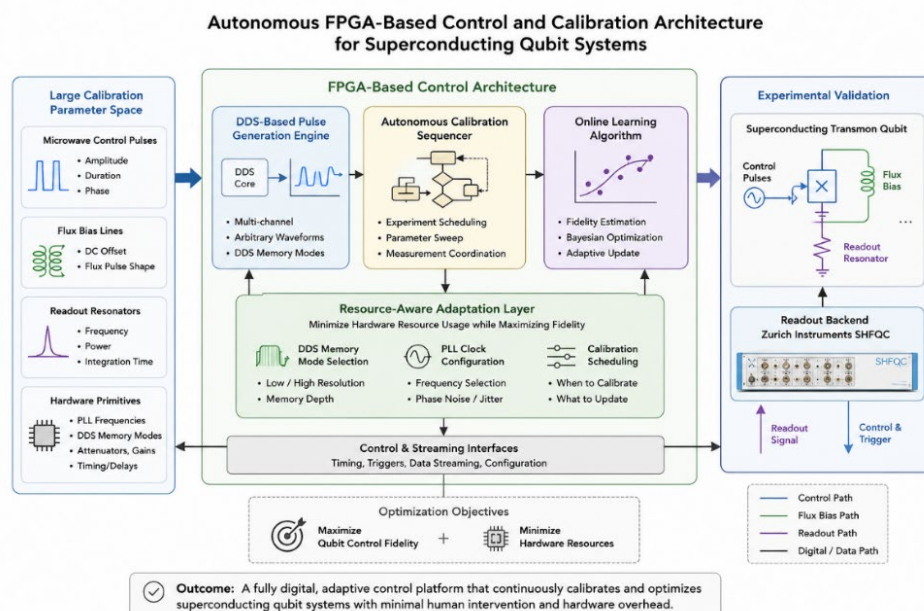
### Responsibility of the student:

1. Taking tasks for designing the processor(controller)
2. Creating a test environment and validating the concepts
3. Finding the optimal calibration procedure

### Required skills:

1. Prior course or project practice in digital design. Processor design is a plus.
2. Basic knowledge of quantum computing.
- 3.

If you are interested, please reach out to Batuhan Keskin. Email: [batuhan.keskin@epfl.ch](mailto:batuhan.keskin@epfl.ch).



(Figure generated by ChatGpt)