QCoDeS Project

Progress Report - July 2022

Summer project at the Q-Si Lab under the supervision of Prof. Mahapatra
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Introduction:

The summer project aimed at designing and delivering RF pulses for single-qubit control and manipulation using an elaborate Python-based framework for computer control of highly sophisticated equipment. The design of RF pulses involves a precise combination of different modulation techniques, particularly I-Q modulation using an Arbitrary Waveform Generator (AWG) to a carrier frequency generated by a Vector Signal Generator (VSG).

In this project, I helped develop Python-based code using QCoDeS, a data acquisition framework developed by the Copenhagen / Delft / Sydney / Microsoft quantum computing consortium, to control an AWG, a VSG, and associated equipment to ”engineer RF-pulses” suitable for quantum control of spin qubits.

Summary:

Wrote a driver for the Proteus P2588B Arbitrary Waveform Generator and implemented functionalities for Segment generation, Tasks, Scenarios, and Triggering. Started working on waveform writing and retrieval using the existing driver for the Keysight MXR2867 Infiniium Oscilloscope.

Learnt the basics of I-Q modulation and instrument synchronization and how it is used in Silicon-based Quantum Computing for gate operations.

Learnt about nano-fabrication methods and how they were used to create a Hall bar probe. Performed measurements on the Hall-bar probe that tested the oxide deposition and ion implantation onto the silicon substrate. It also allowed us to check if ohmic contacts were implanted properly.

Plan:

With the codes and drivers for nearly all instruments ready, the final task at hand is to use the AWG, VSG, and the associated equipment in sync to be able to deliver RF-Pulses and store the response of a sample device for analysis.