

QCoDeS Project

Progress Report - June 2022

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

The summer project aims at developing Python-based codes to control an Arbitrary Waveform Generator (AWG), a Vector Signal Generator (VSG), and associated equipment to engineer Radio Frequency (RF) pulses suitable for quantum control of spin qubits. The project primarily involves using QCoDeS: an open-source, python-based data acquisition and handling framework to facilitate nanoelectronics experiments. Automating measurements using python requires understanding how a PC communicates with any hardware device (instrument) using SCPI commands and being able to write codes using instrument drivers to control the instrument(s).

Summary:

The initial stages of the project involved learning how to control devices with pre-written instrument drivers using QCoDeS remotely. The devices used were the *Keithley 2450* SMU and *Keithley 2000* DMM. We used these devices to do current (I) vs. voltage (V) measurements for simple samples.

Knowing how an instrument driver is written is critical to understanding how experiments can be automated whenever required. Thus, the next logical step was to write a driver from scratch after reading the instrument Manual, SCPI commands and understanding the overall functioning of the device. Consequently, wrote drivers for the *SRS900* Mainframe and associated instrument modules: *SRS918* (Pre-Amplifier) and *SRS980* (Summing-Amplifier).

The next step was to modify the pre-made driver for the QDAC (High precision voltage source) by *Q-Devil* to incorporate required features like arbitrary, sine, square, and triangle wave generation.

Finally, the devices mentioned above were used together with the DSP-7265 Lockin-Amplifier on a JFT-based circuit to study its IV Characteristics and plot 1-D and 2-D maps of differential conductance using QCoDeS.

Plan:

The plan for the remaining duration of the project is to work on writing the driver for the *AWG (Proteus P2588B)* and the *Keyseight (MXR2548)* and use these devices in conjunction with the *VSG (E8267D)* to produce *IQ modulated RF-Pulses*.
