Master’s thesis project at the Quantum Technology Laboratory, Department of Microtechnology and Nanoscience

**Fabrication and characterization of Josephson junctions**

**Motivation:**
In the realm of superconducting circuits, Josephson junctions are devices of crucial importance; their role is comparable to that of transistors in the semiconducting circuits. The reliability of a complicated, multi-qubit superconducting circuit or the performance of a low temperature parametric amplifier depends on the quality of their building blocks, e.g., Josephson junctions. As such, it is essential to monitor the Josephson junction characteristics (normal state resistance, critical current, junction capacitance, and plasma frequency) by fabricating and measuring suitable test structures.

**Project description:**
This project is a statistical study on the uniformity of the fabrication process of Josephson junctions on a wafer, as well as investigation of the process reliability and reproducibility over time. Due to the large number of junctions that are required for this work, an automated setup will be used for measurements. As a part of this master’s thesis project, the student is required to:

- Fabricate Josephson junctions using the already developed methods, with or without some modifications. Each process must be accurately documented.
- Design the automated measurement setup, and characterize the fabricated structures in terms of fabrication yield and normal state resistance.
- Run a statistical study of the measured data.

By working at state of the art cleanroom and laboratories, the student will be familiar with fabrication and characterization methods that are useful for pursuing opportunities in both academia and industry.

More information on quantum computing is available at [http://www.chalmers.se/en/centres/wacqt/Pages/default.aspx](http://www.chalmers.se/en/centres/wacqt/Pages/default.aspx)

**Prerequisites:**
- Course in micro/ nanofabrication
- Course in superconductivity
- Course or interest in electromagnetics, and hands-on experience in microfabrication are not required, but are considered assets.

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