

Quantum Systems Engineering

Special Subjects
Elective 2 credit

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1. Course Description

An overview of the quantum computer system by studying the quantum circuits and examples of hardware. First, you will learn about quantum circuits from their components. Next, you will learn many examples of hardware currently proposed. This course is related to DP1.

This class is provided by faculty members in charge of research and development at private companies.

2. Course Objectives

You can understand the basics of quantum circuits. Then, by learning many hardware examples, you can understand the advantages and disadvantages of individual quantum-computing devices.

3. Grading Policy

Evaluation will be based on small tests and reports (50%) and results of final exams (50%).

4. Textbook and Reference

Textbook

Michael Nielsen, Isaac Chang Quantum Computers and Quantum Communications Cambridge University Press; 10th Anniversary ed. edition (January 31, 2011)

5. Requirements(Assignments)

Please always prepare and review for the class by using textbook (about 1.5 hour each).

The contents of the class are in accordance with the chapters and contents of the textbook.

6. Note

It would be useful to have a scientific calculator.

7. Schedule

- [1] Review of quantum mechanics-Schrodinger equation and perturbation theory
- [2] Quantum circuit (1) gate operation
- [3] Quantum circuit (2) measurement process
- [4] Quantum circuit (3) universal quantum operation
- [5] Quantum simulation
- [6] Conditions for a quantum computer
- [7] Harmonic oscillator type quantum computer
- [8] Quantum computer using photons
- [9] Quantum computer using cavity
- [10] Ion trap quantum computer
- [11] Quantum computer using nuclear magnetic resonance
- [12] Quantum computer using semiconductors
- [13] Quantum computer using superconductivity
- [14] Quantum noise
- [15] Test / Summary