Prosjekt- og MSc-oppgåver 2009 - KoM

Interesserte studentar må ta kontakt med personen som er oppført som rettleiar for å diskutera oppgåva.
Frist for val av oppgåve med start hausten 2009: 19.juni 2009
Ønskje om prosjektoppgåve må sendast til olav.gaute.helleso@uit.no innan fristen.

MSc-projects in Electrical Engineering 2009

Interested students should contact the supervisor and discuss the project.

1. Stroboscopic sampling of UWB signal

Professor Svein Jacobsen, svein.jacobsen@uit.no

The most common ways of sampling broadband signal pulses in the microwave region is by means of the so-called synthetic pulse principle in the frequency domain (”stepped frequency scheme”) or stroboscopic sampling in the time domain. The availability of commercial high quality and compact non-linear components (diodes and transistors) with increasingly larger bandwidths, render realization of equipment and sampling devices in the microwave band for use within UWB radar og communication (3.1-10.6 GHz). The assigment is related to design, simulation and realization of such a compact sampling circuit with at least 6 GHz bandwidth and approximately flat frequency response. Imperative expertise within electronics, microwave technique and numerical computations is needed to accomplish the project.

2. Miniaturization of wireless microwave radiometer

Professor Svein Jacobsen, svein.jacobsen@uit.no

In recent years there has been considerable activity on realizing small, compact radiometers through PhD and MSc students projects at the Electrical Engineering group. From the experience gained in these projects, a wireless, single-channel, pre-prototype medical radiometer based on the Zigbee- protocol, is to be technologically pursued and finalized. The assignment includes design, analysis and testing of the concept as well as application of the instrument on simple liquid phantoms for verification of performance indices like noise factor and absolute temperature accuracy. The project requires background within electronics and microwave techniques and systems.

3. Trapping of nanoparticles with optical waveguides

Associate professor Olav Gaute Hellesø and post-doc Balpreet Singh Ahluwalia
olav.gaute.helleso@uit.no

New tools are necessary to manipulate objects on the nano-scale. It is far from obvious to pick up a nanowire and put it next to the transistor it should be connected to, even if you don’t have big fingers. Optical waveguides have proven useful to trap and propel nanowires, as we have demonstrated over the last few years. In this project, the aim will be to use new waveguide designs and methods to do the trapping more precisely. It will also be an aim to trap new types of nanoparticles, possibly with new functions. The project will involve simulations of optical waveguides and experimental work on characterisation of waveguides

and using them for trapping. It is recommended to have knowledge about photonics and optical waveguides.
See also http://uit.no/fysikk/mikroelektronikk/9

4. Simulation of optical forces on micro- and nanoparticles
Associate professor Olav Gaute Hellesø, olav.gaute.helleso@uit.no

For our work on optical trapping, it is necessary to calculate the forces that the optical field imposes on the trapped particles. This is straightforward for a single, spherical nanoparticle, cumbersome for a single microsphere, and extremely complicated for a collection of non-spherical, micrometer sized objects. In this project, commercial software will be used to simulate the forces on a single microsphere, possibly including the effect of resonances. The numerical method used will either be Finite Element Method (FEM, software Comsol) or Finite Difference Time Domain method (FDTD, software CST Microwave Studio). Knowledge about numerical methods is recommended.
See also http://uit.no/fysikk/mikroelektronikk/9

5. Opto-fluidic sorting of micro-particles
Post-doc Balpreet Singh Ahluwalia and associate professor Olav Gaute Hellesø
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The recent interest and diversified applications arising from the combination of integrated optics (optical waveguides) and micro-fluidics created a new area of research coined ‘Opto-Fluidics’. Optical waveguides is used as a source for exciting, propelling and diagnosing micro-particles and biological cells flowing over it. Similarly micro-fluidics possesses the capabilities to control the flow of sample as desired. The objective of this project is to combine the unique advantage of these techniques to non-invasively sort micro-particles. Optical tweezers can impart ‘selective’ force on the micro-particles to ‘trap’ and ‘place’ them on different micro-fluidic chambers for optical sorting. Similarly optical waveguides can generate the desired force on the micro-particle for sorting applications.

Over last few years we have designed and optimized waveguides of different materials and employed for propelling micro-particles. The student will have an option to use the existing experiment set-up or build his/her own set-up from scratch. Micro-fluidic chambers are already designed and available. The main job for the student is to integrate them and sort micro-particles. Different techniques could be used for sorting particles, including sorting particles of different sizes, and sorting particles bases on florescence. The work is mostly experimental and is suited for candidates who like to build things and spend time doing something interesting, rather than just coding programs!!
See also http://uit.no/fysikk/mikroelektronikk/9