The EMAT electron microscopy research group at the University of Antwerp, Belgium, announces an open

Ph.D. position

on the theme

Optimal experimental design for quantitative electron microscopy

Project

During the last decades, electron microscopy has been characterized by high-technology developments in the microscope design, especially, in the lens design. These developments all aim at an improvement of the resolution in order to simplify the visual interpretation of the images. The resolution which can be obtained with the newest generation high-resolution transmission electron microscopes, which correct for lens aberrations, is of the order of 0.5 Å. By these means, electron microscopy offers the unique possibility to obtain structural information on solids and nanosystems at the atomic scale. Apart from the continuous improvement of the resolution of high resolution transmission electron microscopes, new advanced techniques appear including spherical or chromatic aberration correcting. Furthermore, in our view, new electron microscopes will offer a wide range of possible experimental settings under computer control, such as, defocus, voltage, spherical aberration constant, and energy spread of the electrons. Moreover, the experimenter will have the choice between different techniques e.g., transmission electron microscopy or scanning transmission electron microscopy. The main limiting factors in the experiment will be the incident electron dose, that is, the amount of electrons that interact with the object during the experiment, and the recording time, because of the radiation sensitivity of the object and the specimen drift, respectively. The question then arises which instrument and which microscope settings are optimal given the incident electron dose or the recording time available. To answer these questions, state-of-the-art methods from the optimal design of experiments will be applied in the field of electron microscopy. These methods will allow electron microscopists to evaluate, to compare, and to optimize experiments in terms of the attainable precision with which structure parameters can be measured. Moreover, statistical experimental design provides the possibility to decide whether new instrumental developments result in significantly higher attainable precisions.

Tasks

The PhD candidate will be expected to

- acquire knowledge in the field of statistical parameter estimation theory, statistical experimental design and image formation in electron microscopy
- apply this theory to evaluate the experimental design of existing and new electron microscopy techniques
- implement this theory (preferably in Matlab) in order to numerically evaluate the experimental design
- discuss the results in terms of the expected performance of the technique and fundamental physical limitations

Your profile

Candidates for this challenging project should have a Master's degree and a background in e.g., physics, mathematics, statistics or systems and control. The candidate must be enthusiastic and greatly interested in applied statistics, scientific programming and fundamental theoretical research. A background in electron microscopy will be considered as a plus, but is not necessary. A good command of the English language is required.

Project term

Enrolment will start as soon as possible. The Ph.D. student will be appointed for a period of four years; after the first year an evaluation will take place.

Information and application

Additional information about the vacancy can be obtained from: Dr. S. Van Aert, tel. +32 3 265 3252, Sandra.vanaert@ua.ac.be, University of Antwerp, EMAT, Groenenborgerlaan 171, B-2020 Antwerp, Belgium, http://www.emat.ua.ac.be or from Prof. Dr. P. Goos, tel. +32 3 265 4059, Peter.goos@ua.ac.be, University of Antwerp, Department of Mathematics, Statistics and Actuarial Sciences, Prinsstraat 13, B-2000 Antwerp, Belgium.

Interested applicants should send their Curriculum Vitae, the names of two professional referees, a summary of their M.Sc. thesis and a cover letter stating their motivation to Dr. S. Van Aert and Prof. Dr. P. Goos.

Antwerp, September 2009