Home

CENTRE OF EXCELLENCE

The programme for Centres of Excellence (CoEs) in research is a significant funding scheme in the Finnish research system. The CoE programme offers an excellent opportunity for research teams and consortia to carry out research of a high international standard with six-year funding. The aim of CoE programmes is to create favourable operating conditions for consortia of research teams, create potential for scientific breakthroughs at the interfaces of scientific disciplines and research fields, network Centres of Excellence nationally and internationally and raise the quality standard, international competitiveness, visibility and esteem of Finnish research.

A Centre of Excellence is a competitive, innovative and target-oriented research community with a clear and challenging research vision. A Centre of Excellence is at the international cutting edge of research in its field and renews scientific research and expertise and combines international cutting-edge research.

INVERSE PROBLEMS

Inverse problems appear in several fields, including medical imaging, image processing, mathematical finance, astronomy, geophysics, nondestructive material testing and sub-surface prospecting. Typical inverse problems arise from asking simple questions "backwards". For instance, the simple question might be "If we know precisely the structure of the inner organs of a patient, what kind of X-ray images would we get from her?" The same question backwards is "Given a set of X-ray images of a patient, what is the three-dimensional structure of her inner organs?" This is the inverse problem of Computerized Tomography, or CT imaging.

Usually the inverse problem is more difficult than the simple question that it reverses. For example, even though the Earth's gravitational field is governed by Newton's law of gravitation, the inverse problem of finding sub-surface structures from minor variations of the gravitational field on the surface is extremely hard. Successful solution of inverse problems requires specially designed algorithms that can tolerate errors in measured data.

Inverse problems research concentrates on the mathematical theory and practical interpretation of indirect measurements. The study of inverse problems is an active area of modern applied mathematics and one of the most interdisciplinary field of science.
FINNISH CENTRE OF EXCELLENCE IN INVERSE PROBLEMS RESEARCH

The Finnish Centre of Excellence in Inverse Problems is internationally recognized as the world's leading unit in the field. It specializes in the theory, implementation and application of inversion methods. The objective is to create fundamentally new, efficient, and theoretically sound solutions to practical inverse problems, especially in following application areas:

- Medical imaging.
- Geophysics and space research.
- Remote sensing and modelling in environmental and climate research.

The director of the Centre is Academy professor Matti Lassas (Univ. of Helsinki) and the vice-director is professor Mikko Kaasalainen (Tampere Univ. of Technology). The Finnish Centre of Excellence in Inverse Problems Research is a network comprising research groups in the following institutions:

- University of Helsinki, Department of Mathematics and Statistics, Inverse Problems Group
- University of Eastern Finland, Department of Applied Physics, Inverse Problems and Mathematical Modelling group
- University of Jyväskylä, Department of Mathematics and Statistics, Inverse Problems Group
- Lappeenranta University of Technology, Department of Mathematics and Physics, Inverse Problems group
- University of Oulu, Department of Mathematical Sciences, Inverse Problems Group
- University of Oulu, Sodankylä Geophysical Observatory
- Tampere University of Technology, Institute of Mathematics, Inverse Problems group

Reconstruction of simulated cross-section of human chest from electrical impedance tomography data using a novel reconstruction method