

Inverse and Ill-Posed Problems: Theory, Numerics and Applications

Novosibirsk State University

Degree or qualification is awarded: **Master of science in Applied Mathematics and Informatics**

Language of study: **English**

Mode of study: **full-time**

Duration: **2 years**

Availability of free education: **yes**

Price: **4 300 USD per year**

Programme webpage at the university website:

<https://english.nsu.ru/admission/programs/master-s-degree-programs-english/inverse-and-ill-posed-problems-theory-numerics-and-applications/>

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The main purpose and characteristic feature of the Master Educational Programme "Inverse and Ill-Posed Problems: Theory, Numerics and Applications" is the accessibility of presentation and an attempt to cover the rapidly developing areas of the theory, numerical methods and applications of inverse and ill-posed problems as completely as possible.

In direct problems of mathematical physics, researchers try to find exact or approximate functions that describe various physical phenomena such as the propagation of sound, heat, seismic waves, electromagnetic waves, etc. In these problems, the media properties (expressed by the equation coefficients) and the initial state of the process under study (in the nonstationary case) or its properties on the boundary (in the case of a bounded domain and/or in the stationary case) are assumed to be known. However, it is precisely the media properties that are often unknown. This leads to inverse problems, in which it is required to determine the equation coefficients from the information about the solution of the direct problem. Most of these problems are ill-posed (unstable with respect to measurement errors). At the same time, the unknown equation coefficients usually represent important media properties such as density, electrical conductivity, heat conductivity, etc.

Solving inverse problems can also help to determine the location, shape, and structure of intrusions, defects, sources (of heat, waves, potential difference, pollution), and so on. Given such a wide variety of applications, it is no surprise that the theory and numerical methods of inverse and ill-posed problems has become one of the most rapidly developing areas of modern science. Today it is almost impossible to estimate the total number of scientific publications that directly or indirectly deal with inverse and ill-posed problems. However, since the theory, numerical methods are relatively young, there are many terms are still not well-established, many important results are still being discussed and attempts are being made to improve them. New approaches, concepts, theorems, methods, algorithms and practical problems are constantly emerging.

- Ill-Posed problem concept
- Inverse problems classification
- Regularization methods
- Applications: Geophysics, Medicine, Biology, Finance, Social sciences, Big Data, Data Mining, Machine Learning, Image Processing.

Specializations within this programme