Classical and Nonclassical Problems for Transport Equations

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Abstract

The report contains the short review of author s book Transport Equation and Tomography published in Russian and English. Also some latest author s results are represented.

Mainly, the book is devoted to problems of X-ray tomography, which are meant as problems of determination of the internal structure of an unknown medium by use the results of passing radiation through the medium. From mathematical point of view, these problems are treated as nonclassical problems for the steady-state transport equations (linear Boltzman equations). Research of classical problems for the same equations is considered as a preliminary necessary stage of investigation.

There are several proved and tested algorithms for solving tomography problems in the book. About half part of the book is devoted to the theoretical justification and applications of a new notion the measure of visibility . In particular, it is proved that if the measure of visibility is equal to zero everywhere in the medium, then the internal structure of the medium cannot be determined by tomography methods. Such media are called invisible under radiography. Author s colleague V.Nazarov has implemented some development directed to practical applications of this idea.

In the latest works of the author, more general forms of the transport equation are researched. Particularly, a mathematical model concerning the general case of scattering (Compton s effect and others) is introduced. There are several proved theorems about correctness of classical boundary value problems for the new forms of the transport equation. This stage of investigation is to establish research of tomography problems in a much more wide class of cases.