REGULARIZATION ALGORITHMS: APPLICATIONS

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1 Introduction

Beginning from 1966, we (together with A.V. Goneharzsky, A.S. Leonov and other members of the mathematical school headed by A.N. Tikhonov) proposed new approaches for solving linear and nonlinear ill-posed problems:

(a) on compact sets of bounded monotone functions (with further generalization on sets of convex and monotone convex functions);

(b) in Hilbert and reflexive Banach spaces including cases where the operator (linear or nonlinear) is specified with an error and there exist *a priori* constraints on the unknown solutions (generalized descrepancy principle, generalized discrepancy method etc).

For detailed explanation of the theory and the full list of references , see books [1]–[4]. In [1]–[2] it is possible to find fortran programs (with test examples) for solving linear ill-posed problems with and without *a priori* constraints including one and two-dimensional equations of convolution type.

Now these methods are very well known and used in theoretical investigations as well as in applications. Some applications from astrophysics and vibrational spectroscopy are described below.

2 Inverse Problems in Astrophysics

Astrophysics deals with immensely remote objects, such as stars and galaxies, whose properties can only be measured by those indirect manifestations which are observable from the Earth or from a spacecraft in Earth's orbit. Hence, inverse problems, the majority of which are ill-posed, must be solved in order to interpret observed data. We shall describe only some results from our experience with solving inverse problems in astrophysics, see [4]–[6], and for computer programs (in fortran), refer [6].