

Some numerical methods for gravimetric prospecting

Victor Isakov¹

¹ *Wichita State University, Wichita, USA*

Keywords: *inverse gravimetry; modelling and numerics*

We discuss recovery of a perturbing body from (gradient or higher order gradient) of its gravimetric potential given on a part of the external surface. For numerical reasons we mainly handle the plane case and prescribe the data on an interval of x-axis, while the unknown body is assumed to be a polygon in the lower half-plane. To understand limits of resolution we first give a detailed singular value decomposition analysis of a linear operator which continues the field to outside of a disk including unknown body. We indicate how many parameters are possible to determine depending on the distance from measurement site and size of unknown body. Then we describe two numerical algorithms using complex variables theory which are based on 1) direct (nonlinear) minimization technique and 2) Prony type method. We give many examples of numerical reconstruction for various shapes of unknown inclusion and distance to the measurement site, which show possibilities and limitations of inverse gravimetry. Finally we give a new uniqueness result for recovery of a single layer mass distribution and of lower part of an inclusion (modeling ice with snow layer on top) based on the classical Novikov's orthogonality method (and described in the author's book "Inverse Source Problems", AMS 1990).