A QUADRATIC PROGRAMMING ALGORITHM
FOR GEOPHYSICAL GRAVITY INVERSION
AND OTHER APPLICATIONS

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The geophysical gravity method is described and the corresponding
inverse problem stated as an integral equation. A survey of previous work
associated with gravity data inversion is given followed by an account of
the inherent difficulties associated with gravity inversion; this is done
by a discussion of the integral equation already given, the inversion of
which constitutes an ill-posed problem. The integral equation gives rise
to an ill-conditioned system of linear equations; existing methods for the
solutions of such systems are reviewed. Then follows an account of the
previous use of quadratic programming techniques in the solution of ill-
posed problems.

A new approach to the inverse gravity problem is described, via
formulation as a problem in quadratic programming. This quadratic
programming problem is stabilised (a well-posed problem is created from the
previously ill-posed problem) by the use of both linear constraints and
damping. Two examples of the method, one with field data and one with
synthetic data, are presented, the solutions being effected via an existing
quadratic programming algorithm. This algorithm, however, is unable to
handle certain kinds of *a priori* information associated with the gravity
problem and a new algorithm, based on the existing one, is developed to
handle the additional constraints. The new algorithm is then run on the
two sets of gravity data, having first been tested on a range of other

problems.

     The quadratic programming method of solution for the gravity problem as it is posed is compared with other methods of solution, the comparison being favourable to the quadratic programming approach. The new algorithm is applied to a problem of data approximation and a variation of the new algorithm is applied to a problem in mathematical biology. The thesis concludes with suggestions for future work.

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