Interpretation of Potential field data using Backus and Gilbert Inversion Technique

by

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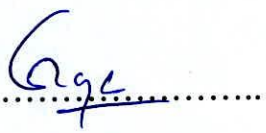
Thesis submitted to the University of Sri Jayewardenepura for the award of the Degree of Master of Philosophy in Mathematical Physics on 2013.

"The work described in this thesis was carried out by me under the supervision of Professor D.A.Tantrigoda and Professor Arjuna de Zoysa and a report on this has not been submitted in whole or in part to any University or any other institution for another Degree/Diploma''.



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"We certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation''.

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I certify that the candidate has incorporated all corrections, additions and amendments recommended by the examiners.

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Prof. D.A. Tantrigoda

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ABSTRACT

The main objective of this study is to test the hypothesis that gravity anomalies could be modeled in terms of bodies having density that vary with depth using the Backus and Gilbert inversion method. The hypothesis was tested using a series of numerical experiments involving calculation of the gravity anomaly due to model geological structures of known dimensions and known vertical density distributions and then modeling them using the Backus and Gilbert method. This in fact is a problem in the linear inverse theory and such problems are ill posed in general. To overcome this difficulty the Singular Value Decomposition method has been successfully adopted.

The study was conducted with simulated data and to make them resemble real observations, a certain amount of random errors were added.To recover the assumed structure of the causative body, "weighted distance" minimization was applied at the latter stages of the inversion process. The method presented in this study can be used successfully to model gravity anomalies caused by;

(1) Common geological structures (sedimentary basins, igneous intrusions and geological faults) with densities that vary with depth closest to a given relationship and

(2) A sedimentary basin of constant density having a high dense igneous layer intruded into it. Density variations with depth have been expressed in terms of local averages using averaging kernels.

This method may have useful applications in the oil and gas exploration work especially in view of its ability to identify thin igneous layers intruded in to sedimentarybasins.