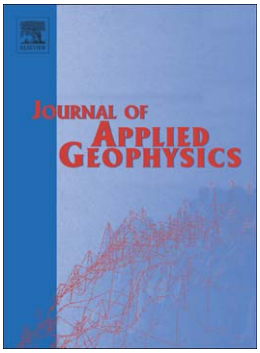

A new segmentation strategy for processing magnetic anomaly detection data of shallow depth ferromagnetic pipeline

Shuo Feng, Dejun Liu, Xing Cheng, Huafeng Fang, Caifang Li

PII: S0926-9851(16)30404-9
DOI: doi:10.1016/j.jappgeo.2017.02.009
Reference: APPGEO 3212

To appear in: *Journal of Applied Geophysics*

Received date: 14 October 2016
Revised date: 27 December 2016
Accepted date: 13 February 2017

Please cite this article as: Feng, Shuo, Liu, Dejun, Cheng, Xing, Fang, Huafeng, Li, Caifang, A new segmentation strategy for processing magnetic anomaly detection data of shallow depth ferromagnetic pipeline, *Journal of Applied Geophysics* (2017), doi:10.1016/j.jappgeo.2017.02.009

A New Segmentation Strategy for Processing Magnetic Anomaly Detection Data of Shallow Depth Ferromagnetic Pipeline

Shuo Feng[1 2], Dejun Liu[1 2*], Xing Cheng[1 2], Huafeng Fang[1 2], Caifang Li[1 2]

[1] State Key Laboratory of Petroleum Resources and Prospecting, China University of Petroleum, Beijing 102249, China;

[2] College of Geophysics and Information Engineering, China University of Petroleum, Beijing 102249, China;

* No. 18, Fuxue Road, Changping, Beijing 102249, China; E-Mail: liudj65@163.com (D. J. Liu); Tel.: +86-10-89731772; Fax: +86-10-89731772.

Abstract

Magnetic anomalies produced by underground ferromagnetic pipelines because of the polarization of earth's magnetic field are used to obtain the information on the location, buried depth and other parameters of pipelines. In order to achieve a fast inversion and interpretation of measured data, it is necessary to develop a fast and stable forward method. Magnetic dipole reconstruction (MDR), as a kind of integration numerical method, is well suited for simulating a thin pipeline anomaly. In MDR the pipeline model must be cut into small magnetic dipoles through different segmentation methods. The segmentation method has an impact on the stability and speed of forward calculation. Rapid and accurate simulation of deep-buried pipelines has been achieved by exciting segmentation method. However, in practical measurement, the depth of underground pipe is uncertain. When it comes to the shallow-buried pipeline, the present segmentation may generate significant errors. This paper aims at solving this problem in three stages. First, the cause of inaccuracy is analyzed by simulation experiment. Secondly, new variable interval section segmentation is proposed based on the existing segmentation. It can help MDR method to obtain simulation results in a fast way under the premise of ensuring the accuracy of different depth models. Finally, the measured data is inversed based on new segmentation method. The result proves that the inversion based on the new segmentation can achieve fast and accurate inversion of depth parameters of underground pipes without being limited by pipeline depth.

Key word: magnetic anomaly magnetic dipole reconstruction segmentation method

1.Introduction

The underground pipeline system is one of necessary material guarantees for modern life. To avoid economic losses and even casualties caused by the damage of unknown underground pipelines during the engineering construction, it is necessary to know their distribution (McConnell et al 1999, Allred and Redman 2010, Gong et al 2011). Magnetic anomaly detection (MAD) method is an effective tool to detect the depth and horizontal information of underground pipelines (Guo et al 2015).

The research on MAD is mainly divided into two parts: forward and inversion (Lelièvre and Oldenburg 2006, Sun and Chen 2016). Forward modeling of MAD, as the basis for interpretation, processing and inversion of data is one of the focuses of research. Nowadays both finite element