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無人ヘリコプタを用いた重力・磁気探査システムおよびデータ処理手法の開発
A Development of Airborne Survey of Gravity and Magnetics on an Unmanned Helicopter and Its Data Processing

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It is important for the regional earthquake disaster prevention to make a model of ground structure and clarify the non-fairing nature of the ground in detail. For this purpose, gravity and magnetic surveys can be used to estimate the deep and vast velocity and density structures of the ground because of quick observations.

Nowadays, since these implements such as gyroscopes, accelerometers, computers and GPS measurement system are dramatically improved, observation system becomes much smaller and higher-performance. We now aspire to make observation system simple, which sensors installed directly on the career, then correct the observed data by post processing from the accurate posture data. Furthermore, the new accelerometer sensor “D-servo,” which has enough dynamic range for the carrier disturbance and resolution for detection of gravity anomaly had been developed as shown in Yokoi et al.(2012).

To discuss the sensitivity and practicability of the exploration system, airborne survey has been carried out. We set the observation system on an autonomous-cruise-type uninhabited helicopter and navigate it over a huge concrete gravity dam, which makes large gradient in gravity, with some magnetic body as flood spillway. By means of GPS data of each cruise, theoretical gravity is calculated from terrain model made of 50m-mesh rectangular parallelepiped which height is altitude. Effects of stored water and dam itself are also considered.

As results from the observation, it is observed that sensitivity of the magnetic survey was quite well, though, inclination correction seems to be required for the gravity survey. For the accurate correction, we should consider some suitable way of the calibration of sensors. Improved method for gravity analysis is also proposed and the result has quite good agreement with theoretical gravity in phase and period of the signal. An mesurement and algorithm might be required to determine the accurate inclined angles for the correction as future development.

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