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移動体用重力探査システムにおけるデータ解析手法に関する研究
An Advanced Method of Data Analysis for Gravity Exploration System on a Mobile Vehicle

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A model of ground structure is very important to estimate earthquake ground motions. Gravity survey is one of exploration methods. We can estimate ground structure by using information of gravity anomaly which comes from heterogeneous density structure of the ground. Generally speaking, there are high correlation between density and velocity structure of the ground. Thus, the gravity survey is comparatively easier than other exploration method to estimate the ground structure, so that it is very suitable for the aspect of the seismic hazard projection.

For gravity survey, spring-type relative gravimeter is usually used. This type of gravimeter can provide accurate data, however, it is very expensive and difficult to handle. Furthermore, it takes much time to obtain adequate data. We, thus, began to develop a simple and inexpensive sensor which can measure gravity anomaly on a moving vehicle, such as air, land, and sea vehicles, that is, airplanes, motor vehicles, and ships. In a case where a gravimeter is used with a moving vehicle, we may survey the gravity over larger area in shorter time than using conventional survey techniques.

Generally, the gravity should be measured with resolution of 10 micro Gal at least for survey to estimate ground structure. However, the signal obtained from sensor is contaminated by various noise such as vibration of a moving vehicle etc. This means that a sensor with high resolution and large dynamic range is required. This is difficult to realize because resolution and dynamic range are conflicting requirement. To solve this problem, we have developed a sensor with a new feedback system, which has high resolution and large dynamic range.The performance of this sensor is examined in this study, and we also propose a technique of data processing based on the combination of second order blind identification (SOBI) and Hilbert Huang transform (HHT) technique.For this two different type of observations are carried out.

First, we set the sensor statically in a tunnel to confirm whether the sensor can respond to the gravitational effects caused by earth tides. From this observation, it is found that the sensor is affected by atmosphere. The effect is can be removed by applying second order blind identification (SOBI).

Second, the ship survey is carried out.Through a technique of data processing based,the observed data provide quite good agreement with theoretical gravity in phase and period of the signal.

Keywords: gravity survey, Hilbert-Huang Transform, Second Order Blind Identification