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STT03-P03 Room:Convention Hall Time:May 23 17:15-18:30

Performance of digital servo sensor for gravity survey using a carrier

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Modeling ground structure is one of the most important topics for the estimation of seismic hazard these days. 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 the 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. From these reasons, data which is required to model ground structure is not so enough in the present time.

Under such background, we began to develop a simple and inexpensive sensor which can measure anomaly on a mobile carrier, such as vehicle, ship, aircraft, and so on. In a case where a gravimeter is used with a mobile carrier, we may survey the gravity over larger area in shorter time than using conventional survey techniques. Generally speaking, for the gravity survey, the gravity should be measured with resolution of 10 micro Gal at least. However, the signal obtained from gravimeter is contaminated by various noises: vibration of a carrier, circuit noise of a system, fluctuation of temperature, and so on.

Thus, we have to develop a sensor, and a method to analyze observed data, which can provide accurate data of gravity under very noisy environment.

We have developed a new sensor with digital feedback system, which has high resolution and large dynamic range. The performance of the sensor is examined in this study. For this purpose, two different types of observations were carried out.

From the static observation in a tunnel, it is found that the sensor can respond to gravity caused by the earth tide. Furthermore, we can say that the algorithm of digital feedback system has room for improvement.

From the observation on a ship, high frequency vibration which has big amplitude makes the gravity blind. If the carrier's vibration is so strong, it is impossible to estimate gravity using simple filtering. However, we can obtain the signal correspond to the gravity from Hilbert Huang Transform (HHT).

Keywords: gravity survey, digital feedback system, Hilbert-Huang transform