

## 【Grant-in-Aid for Young Scientists(S)】

### Integrated Science and Innovative Science (New multidisciplinary fields)



**Title of Project : A new development of inversion technique to estimate 3-D ground structure using microseism, gravity, and magnetic surveys**

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Research Area : Natural disaster science

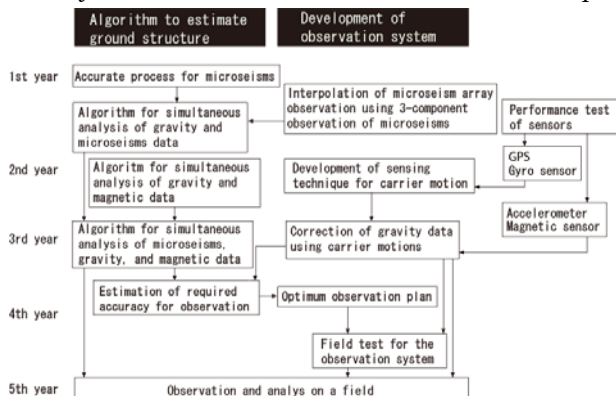
Keyword : Damage prediction/Analysis/Mitigation measures

#### 【Purpose and Background of the Research】

It is very important to know the deep for estimation of earthquake ground motions. Some of parameters for the ground have physical relationships among them, thus, we can use these relationships as constraints to estimate the ground structure. The constraints will provide the better results than results obtained from individual techniques, even though the accuracy of each survey technique is not so good. From this, we apply simultaneously the microseism, gravity, and magnetic surveys, which are not so costly, to estimate the three dimensional ground structure. Furthermore, for the quick observations, we also develop a new observation technique to carry out the gravity and magnetic surveys using a carrier such as a vehicle and a radio controlled helicopter etc.

#### 【Research Methods】

At the first year, the basic framework for algorithm will be developed. For the microseism survey, we develop a technique to estimate accurately using the phase velocities of Rayleigh and Love waves and ellipticity of Rayleigh wave. Then, a method to analyze the gravity and microseism data simultaneously is also developed. After that, we develop a technique to estimate the ground structure using microseism, gravity, and magnetic data simultaneously. For the quick observation, a observation system on a carrier such as vehicle and radio controlled helicopter. For this purpose, a method for accurate sensing and analysis of the carrier motions will be developed



using GPS and gyro sensors. At the final year, whole the developed techniques are tested on a field. The figure shows the flowchart and summary of the research plan.

#### 【Expected Research Achievements and Scientific Significance】

We deal with techniques to estimate 3-D ground structure from the view points of the observation and analysis. On this way, we will develop many kinds of elemental technologies: for example, new method for inversion from the analysis, accurate sensing techniques of carrier motion from observation, and so on. These elemental technologies should be very basic and can be applied to many kinds of different engineering fields, such as information system for safety navigation of airplanes and ships, and health monitoring system of structures, etc.

The results obtained from this research project should be new horizon for the survey of ground structure and provide more accurate estimations under less cost than any other conventional techniques. This means that the result can contribute to mitigate the earthquake disaster in the world.

#### 【Publications Relevant to the Project】

- Takahashi, Morikawa, et al., "Modeling of a 3-D subsurface structure around damaged area due to the 2004 Niigata-ken chuetsu earthquake using gravity survey," Zishin, Vol.61, No.2, pp.33-48, 2008 (in Japanese).
- Sakai, Morikawa, et al., "An application of the technique for estimation of subsurface structure using joint inversion of gravity and microtremor data," Proc. 12<sup>th</sup> Japan Earthquake Engineering Symposium, pp.274-277, 2006 (in Japanese).

#### 【Term of Project】

FY2009-2013

#### 【Budget Allocation】

67,700 Thousand Yen

#### 【Homepage Address and Other Contact Information】

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