Department of Architecture and Civil Engineering	Key words	Earthquake hazard assessment, MEMS sensor, Structure monitoring

Dr. Eng. / Professor

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Education

Ibaraki University Faculty of Engineering Department of Urban Systems Engineering Graduated in 2000
Master's Program at Kanazawa University Completed in 2002
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Professional Background

Maizuru National College of Technology, technical staff
2012 Japan Society for Earthquake Engineering Paper Encouragement Award

Consultations, Lectures, and Collaborative Research Themes

Seismic hazard analysis, Structure monitoring using MEMS sensor, Ground structure survey based on microtremor observation

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Main research themes and their characteristics

「Seismic hazard assessment integration」

Evaluation of seismic hazards the basis of earthquake disaster prevention plans in national and local governments, and is extremely important in reducing damage from huge earthquakes such as the Nankai Trough earthquake.

In general seismic hazard assessment, various conditions and parameters are set for an assumed earthquake, earthquake motion prediction is performed, and damage to structures, is predicted based on the results. On the other hand, the method of this study is based on the theory of random vibration, and directly evaluates the index indicating the degree of damage to the target structure from the effects of the source and propagation path and the site amplification effect (see Fig.1). By using this method, it is possible to save time and effort for earthquake motion prediction, and to investigate the degree of influence of the above three effects of earthquake motion on structural damage, which is also useful when analyzing damage factors.

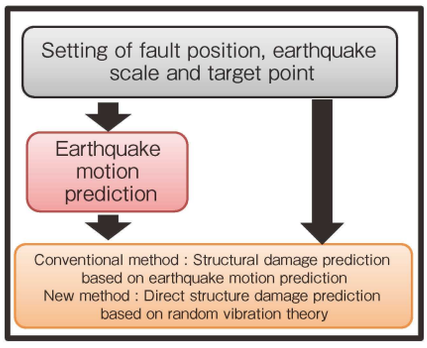

Fig.1 Conventional and new methods for seismic hazard assessment

「Structural monitoring using low-cost compact MEMS sensor」

An expensive servo-type instrument has been used for vibration monitoring used to evaluate the soundness of structures, but in this research, a sensor using MEMS (Micro Electro Mechanical Systems) technology, which has been rapidly developing in recent years, has been used.

The MEMS sensor has the merit that it is small and very cheap compared to the servo type instrument, but it is difficult to measure vibration with small amplitude due to its performance. However, the high-precision MEMS inclination sensor used in this research is small, It has the performance required for monitoring at a low price.

Fig.2 shows a vibration measuring device (length 7.2 cm, width 9.5 cm) made by soldering a MEMS sensor to the substrate. As a result of evaluating the fundamental natural frequency of a wooden building using a vibration measuring device and a servo-type accelerometer, it was shown that the values for each were almost the same. The results obtained in the main paper 1 are published.

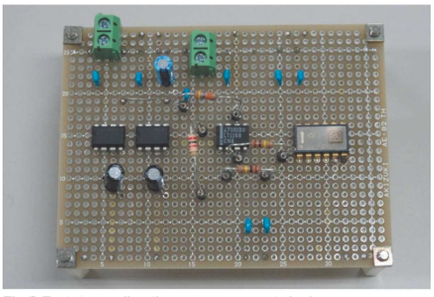

Fig.2 Prototype vibration measurement device

Major academic publications

Hayato NISHIKAWA, Tomiya TAKATANI, Toshikazu IKEMOTO, Masakatsu MIYAJIMA : Evaluation of natural frequency of wooden buildings by single point measurement of small MEMS sensor, Journal of Structural Engineering, Vol.66B, pp.315-322, 2020.
Hayato NISHIKAWA, Tatsuya NOGUCHI, Isamu NISHIMURA, Masakatsu MIYAJIMA, Takao KAGAWA : A study on evaluation formula for maximum response deformation angle of wooden building in the 2016 central TOTTORI earthquake, JSCE Journal of Earthquake Engineering, Vol.75, Issue 4, pp.383-390, 2019.

Hayato NISHIKAWA, Tatsuya NOGUCHI, Masakatsu MIYAJIMA, Takao KAGAWA : A Study on an Empirical Formula for Amplification Factor Based on Fundamental Peak Frequency and Amplitude of Microtremor H/V, Journal of Japan Association for Earthquake Engineering, Vol.19, Issue 7, pp.41-55, 2019.