김일성종합대학학보
(자연과학)
주체103(2014)년 제60권 제6호

JOURNAL OF KIM IL SUNG UNIVERSITY
(NATURAL SCIENCE)
Vol. 60 No. 6 JUCHE 103(2014).

Digital Observation System of Microseisms using MP426 Data Gathering Card

Cha Sin Hyok, Mun Song Chol

Microtremor exploration using the microtremor, the ambient vibration of the underground, is the comfortable exploration method for assessing the subsurface soil structures. So it is widely used in several sites including cities as an effective method to estimate the subsoil structures of the underground [1, 2].

In order to estimate the subsoil structures by the microtremor exploration method, we must establish the observation system, which can change the ambient vibration signals from various seismic sensors into digital data and observe and record them simultaneously.

In this paper we made up the digital observation system of microseisms employing the MP426 data gathering card, with which we can proceed real time observation and recording of signals from several channels.

1. Constitution of the Observation System

1.1. Sensors and preamplifier

In this observation system the short period electromagnetic seismometers (vertical) are used. (Fig.)

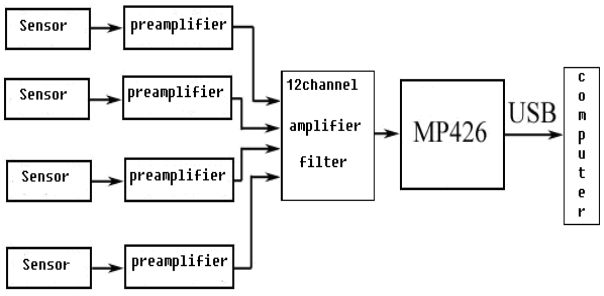

figure. Constitution of the observation system.

The characteristic oscillation frequency of these sensors is 1 Hz.. The preamplifier is made to amplify the weak signals from the sensors, and the amplification degree of the preamplifier is 200. The electric power of these amplifiers is supplied from the dry cells, which is very comfortable in field experiment. Six dry cells (AA3) are used in every amplifier to supply DC ±4.5V .

1.2. Amplification filter

The analog signals from the preamplifier are sent to the vibration signal processing and connection equipment for twelve channels through cables. They are band filtered and amplified, and then connected to the analog input cable of the MP426 data gathering card. This filter consists of two low-pass-filters, which remove the high-frequency noise and strengthen the useful signals in low frequency. And the break frequency of this circuit is set up as 40 Hz.

The final signals, filtered and amplified through this circuit, are sent to the MP426 data gathering card through twenty lines cable. This block's power is also designed to supply ±4.5V with the dry cells, which is comfortable in field observation.

1.3. 12 channel-16bit data gathering card with USB port

MP426 is a versatility data gathering card with USB2.0 port, which has various ability such as input analog signal through 12 channels, 16 A/D converting capability and so on. And it enables us to gather real time data by connecting to computer through USB port. The 8Mbyte-DFIFO is also settled in this card, which makes it possible to buff the sampling data (eight seconds is maximum).

1.4. Observation program

All operations such as input/output of the data from the card, real-time display, settings of the sampling frequency and the data length, and saving data are proceeding by the observation program in computer. This computer program is written in C++.

2. Assessing the Reliability

We connect a sensor to the first channel and observe the signal to see whether the equipment runs correctly. The real-time signal is correctly displayed only in the first channel and there is no signal in other channels, that is, there is no interference between the several channels.

In the same way we check the other channels, which show that there is no interference between them. And then we connect an oscillator instead of the seismometer and input sine signal, which displays the same sine signal in the screen. On the other hand, we connect the seismometer and input the data length which we need, which show us that the data is correctly saved.

Conclusion

By establishing the digital observation system of microseisms, we have built the base to estimate the underground structure in the studying area by the tremor survey method such as SPAC method.

References

[1] M. W. Asten; Geophysics, 71, 6, 153, 2006.

[2] Q. F. Chen et al.; Chinese Science Bulletin, 54, 2, 280, 2009.