

Method of determining the total cost in each year of operation of municipal solid waste management projects in Vietnam

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Abstract. With strong urbanization in the past decade, Vietnam has faced great challenges in urban management and municipal solid waste management is one of them. In the past, most of municipal solid waste was buried, but in recent years the landfills have been limited and replaced. The projects are invested with large scale, modern disposal technology. The investment process of projects must assess the project efficiency in terms of financial and social aspects. In particular, the benefits and costs of the project should be clearly analyzed. In terms of cost, the total cost allocated to a tonne of municipal solid waste treated during the operation phase must be determined accurately and appropriately. Therefore, it is necessary to develop a method for determining the total investment cost of municipal solid waste management projects in the operation phase. This study has two main purposes. The first is to establish a complete methodology to determine the total cost of project in operation phase based on theory of V.Liogkas. The second is to apply the above method to calculate the typical municipal solid waste management project in Vietnam.

Keywords: *municipal solid waste, municipal solid waste management, total cost, Vietnam*

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Development and Application of Structural Health Monitoring using Low-Cost MEMS and Arduino Nano Microcontroller Board

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Abstract. The study presents cheap vibration measurement approach for dynamic responses of fixed-fixed beam model by using Accelerometer and Arduino Nano board. Low-cost MEMS (MMA845X) with triple axis accelerometer are programmed to connect in Arduino Nano microcontroller board via standard I2C bus. The MEMS signals in real-time are collected by embedded codes in Matlab and Arduino software over the serial communication. MEMS data of historical responses on steel beam from Arduino Nano are analyzed to calculate fundamental frequency via fast fourier transform (FFT) algorithm. The natural frequency of beam is measured, compared and predicted with commercial calibrated accelerometers.

Keywords: *Arduino Nano, MEMS, MMA845X, Structural Health Monitoring, Vibration, FFT.*

Wave Disasters and a Swell Prediction System

Based on Observation in Toyama Wan

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Abstract. The large swells invade the Toyama Wan from October to April every year, and cause wave disasters on the coast of Toyama Wan. The swells have troubled the people since long ago, and therefore the people named the swells "Yorimawarinami" more than 150 years ago, in order to warn of them. It was cleared by previous studies that swells in coastal water have the following characteristics.

- (1) Big swells attack suddenly on the coast of Toyama Wan when low pressure pass across Japan Sea and stay around Hokkaido and strong north wind blow in the west sea area of Hokkaido.
- (2) Swells change the wave direction to the right due to Tushima current in the area between Noto Hanto and Sado Shima.
- (3) Swells generate proper oscillations with several minute periods in coastal shallow water.
- (4) Swells beat with the same period as period of proper oscillation due to the proper oscillation.
- (5) Swells cause big waves rarely in coastal water when swells invade the coast of Toyama Wan.

After 1970, big wave disasters have occurred on the coast of Toyama Wan with recurrence period of about 10 years. For example, ship dragging anchor and grounding, destroying wave dissipating blocks and brakewaters, invading residential quarters over breakwaters, and breaking houses. It is considered that water level fluctuations mentioned above, such as proper oscillations in coastal shallow water and beat phenomena of swells, are causes of the wave disasters. Therefore, it is very important to predict the swells exactly in order to prevent wave disasters. Currently Toyama Local Meteorological Office predict them in Toyama Wan using numerical wave prediction model, but it is difficult to predict swells with high reliability. Now, it is proposed to construct a wave prediction system based on observation using radars and wave meters for preventing wave disasters on the coast of Toyama Wan. It was suggested that the swell prediction system by catching swells off the apex of Noto Hanto with the system combined of a wave meter and a radar is effective to prevent wave disasters on the coast of Toyama Wan.

Keywords: *Swell prediction system; Wave disasters; Toyama Wan; Yorimawarinami*

Development of simple water environmental analysis with high performance combination with chemical and information technology

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Abstract.

Water pollution with heavy metal compounds of one of the serious environment problems in developing country. Instrumental analyses techniques including are typically used to determine heavy metal compounds with high sensitivity. However, these techniques require expensive instrumentation and complex operation. Thus, development of simple on-site analysis for arsenic has been desired. Colorimetry is one of the useful on-site analysis in not only environmental field but also several kinds of field, because of unnecessary analytical instrument. However, this analytical method is lack of sensitivity, and colorimetric determination cause individual different of analytical result. Recently, portable size color analyzer has been developed and commercially used. Although, by the use of this analyzer, sensitivity and accuracy is able to be improved, analytical cost is increased. On the other hand, Smart device such as smartphone and tablet device has several kind of function such as telephone, e-mail, network, mapping, clock, imaging system with low cost, and the function of smart device is able to be customize easily by application software. Therefore, smart device is rapidly spreading in the world including developing country. In this presentation, we introduce simple analysis using smart device as color analyzer for colorimetry. This method consists of original attachment manufactured from 3-dimensional printer and original application software. By using original attachment, an image of the sample is captured to image sensor of smart device with a constant distance and illuminance. Using original allocation software, the color information and color intensity from sample image is measured and convert to concentration. As a result, using this method for several colorimetric methods, it was confirmed that quantitative result was obtained in both methods, and in terms of sensitivity and accuracy, this method was equivalent to the conventional method. Moreover, analytical result is able to be displayed on map using GPS and mapping function of smart device. Furthermore, proposed method can handle various sample type such as solution and test paper type, by customizing the attachment.

Keywords: *Colorimetry, smart device, original attachment, application software*