

Multipurpose OBS tester

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1. Introduction

When we started to think about how we could perform the tests to check the new OBS, we realized it would be very useful to have a small electronic device that could give us real time data while working in real conditions, that is, under the water and with autonomous power supply.

At the beginning, the main purpose of this project was the construction of a device that could measure the environmental conditions inside the sphere where all the electronic device were working. Immediately we realized it would be interesting not only to measure the environmental conditions, but also to perform other measures that will serve to understand better what was happening inside the sphere. We therefore decided to add new tasks to the system for getting information from the sensors or measure electrical parameters.

The characteristics we looked for in the device were if it could get real-time data about environmental conditions, electrical parameters and sensors, and could be useful for testing other devices.

2. Results and Discussion

Basically the system has two main parts. One is a hardware part that collects the data from the device and sends it to the surface. The other part is software installed in a computer on the surface which main duties are to store and display the data from the sphere.

The hardware system we are developing presently can be divided into five main blocks according to its function: acquisition system of environmental conditions, acquisition system of seismological sensors, acquisition system of electrical signals, an interface with the surface and a microprocessor that controls all the systems. See fig. 1.

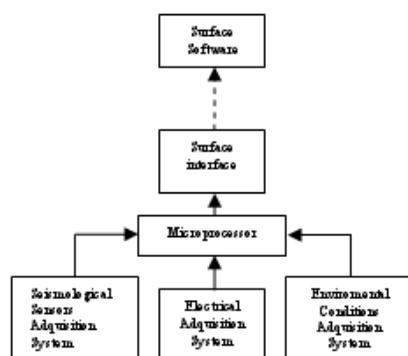


Figure 1. OBS tester Diagram bloc

The task of the acquisition system of seismological sensors is to receive the data coming from the digital filter of the acquisition system of the OBS. We make this acquisition via an SPI bus. After that, we send the data to the surface. The main objective of this part is to get real time data from the OBS without having to wait until the end of the tests that could be more than one week long. You can also send acoustical signals to the OBS and see its response.

The task of the acquisition system of environmental conditions is to receive the data coming from a temperature, humidity and pressure sensors inserted in the same device. The main purpose of this block is to track these variables during all the tests. It also has to serve as a security system to avoid the electronic parts from being damaged. We will know if the water gets into the sphere via the pressure sensor and we could try to recover the OBS before it gets full of water and damages the electronic parts. We can also see if we have water condensation inside the sphere and try to find a way to resolve that problem.

The task of the acquisition system of electrical signals is to measure voltages coming different parts of the OBS's electronic parts. It could serve for tracking parameters as the voltage reference of the A/D or the evolution of the batteries.

The main task of the microprocessor is to control the whole system and give a base time for posterior analysis of the acquired data.

The surface interface can be divided into two parts. One is the supply system and the other are two RS422 channels used to send all the information. We use one of the channels for sending all the information coming from the seismological sensors and the other one for sending the data coming from the environmental sensors and the electrical signals data acquisition.

The software part is a LabView program that receives all the data and stores them in an ASCII file. The program can also be used to visualize the data.

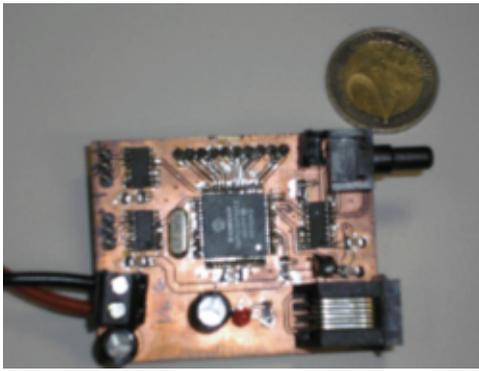


Figure 2. OBS tester photograph

3. Conclusions

At this moment, the system is almost finished. We only have to calibrate the sensors and ensemble some parts of the microprocessor's program that have already been tested separately. As the main characteristics of the device, we can say it gets data from the seismological sensors every 4 ms, data from the environmental conditions every minute and data from electrical signals every 4 ms. Now we are thinking about how to improve the device by incorporating new sensors as a tilt sensor and trying to get data from electrical signals more often.

MiniDOBS Stability and Floatability

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Introduction

Marine Seismometers (OBS: Ocean Bottom Seismometers) are instruments that are widely used [1]. Their mission is to register and store different data series of physical magnitudes, as water pressure and ocean bottom vibrations, etc.. They are used for the geological study of the marine bottom structure and seismicity. Marine Technological Unit (UTM) of CSIC is in charge of the Spanish OBSs which are called MiniDOBS (Mini Digital Ocean Bottom Seismometer). The first ones were built in 1997 in Bullard Labs of the Cambridge University (UK).

The empirical knowledge of the mechanical behaviour of such equipment [2] has taken us to carry out a stability and floatability study and finally a mechanical characterization. To do that, it was necessary to gather the related technical documentation. Ten sketches were obtained from the original ones drawn by T. Owen from Cambridge university. The rest were carried out from direct measurements of different elements of the MiniDOBS.

This study contains the stability and floatability calculations of the MiniDOBS in 3 stages of its operation cycle: the immersion, ocean bottom deployment and rise to the surface.

2. Results and Discussions

In order to analyse the mechanical behaviour of the MiniDOBS, a study of each component was carried out using the autoCAD software tool [3]. In table I, the mechanical features are shown: material type, density and mass of each component of the instrument.

Once each element is identified and characterized, the geometrical centre (CG) that depends on the geometry, and centre of gravity (CM) that depends on the material, in the indicated situations (immersion, ocean bottom and rise), were calculated. Elements made of one material were separated from the ones composed of several types. A standard analytical method (that is often used in elements with simple geometrical shape, therefore the ones that can be decomposed to simple figures: cube, sphere, cylinder, cone, etc.) was used, and when needed, a consistent manual method to find the intersection of vertical lines, perpendicular to floor passing through different subsection points [4], [5].

All the data relative to decomposition as well as sketches drawn and the results of the calculations are available at www.cdsarti.org.

3 Conclusions

The results obtained allow us to characterize the MiniDOBS mechanically and obtain a better knowledge of the behaviour during different operation cycles (immersion, ocean bottom deployment, rise). The stability and floatability of the equipment are studied and analysed in detail, establishing a general method applicable to other volumetric bodies.

Specifically, the results can be summarized in the following way. At immersion stage, the equipment is in total equilibrium stability (CG and CM in the same line of action). When the instrument is sitting on the ocean bottom, it is at total equilibrium. At the rising stage, the instrument is at partial stability. There is a small