OVERVIEW OF EXISTING INSTRUMENTATION RELEVANT FOR OCEAN OBSERVATORIES

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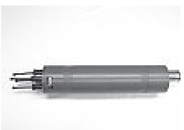
More than two decades of technical development in electronics, telecommunication, optics and acoustics measuring techniques have opened new possibilities for on-line monitoring of the marine environment. Increasing computing and filtering capacity of instruments and sensors have increased the measurement accuracy at the same time as the equipment has been made smaller, long-term stable and consume less energy. Advances in telephone and satellite communications have increased the capacity to transfer data in real time, or close to, from any part of the world to the home office.

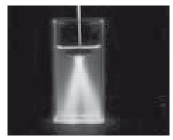
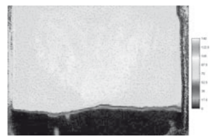
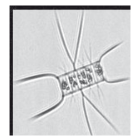
The term ocean observatory is interpreted differently depending on which investigator is asked. The users of profiling Argo floats (http://www.argo.ucsd.edu/) will often refer to their instruments as the world's biggest array of ocean observatories including more than 3000 units. Environmental buoy based monitoring systems with real time transfer of data have been established in various parts see e.g. http://www.poseidon.ncmr.gr/; http://www.gomoos.org/; http://www.pmel.noaa.gov/tao/; http://www.puertos.es/index.jsp and http://tabs.gerg.tamu.edu/Tglo/. Also many ports and harbors operate on-line installations, mainly used for navigational safety, which could be regarded as combined Oceanographic/Meteorological observatories e.g. http://online. msi.ttu.ee/tallinn/?eng and http://www.azti.es/ingles/estation.asp.

More recently large and expensive cabled observatories with high measurement and experimental capabilities have been installed. The first was set-up in Sagami bay off Japan (http://www.jamstec.go.jp/jamstec/station.html). Others have been installed off the Canadian west coast (http://www.venus.uvic.ca/), off the French Mediterranean coast (http://antares.in2p3.fr/), off Oman (http://www.lighthousehouston.com/technology/lori/video) and off the US west coast (http://www.mbari.org/mars/).

Regardless off which platform serve as support for the measurements they all carry sensors which are more or less mature for long term deployments on observatories. In this presentation the performance (accuracy and longterm stability) of a selection of chemical, physical and biological sensors will be addressed and exemplified with data from a wide variety of environments. Immerging sensor technologies will also be discussed. Also the successful combined use of sensors and mechanical actuators (on long term observatories) will be addressed.



THE EFFECT OF HYSTERESIS ON THE FLUXGATE SENSOR BEHAVIOR

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Abstract - This paper describes the principle of operation of the fluxgate sensors. The effect of the magnetic hysteresis was specially taken into account. It was found that the hysteresis does not distort the linear characteristic of these devices.

I. INTRODUCTION

Different methods and techniques have been used for the measurement of magnetic fields. They are based on different phenomena, such as induction, Hall effect, magneto-resistance, magneto-optic effects or super-conducting quantum effect.

In this paper our aim is to describe the fluxgate technique [1,2] and to investigate the influence of the ferromagnetic hysteresis on the device behavior.

The fluxgate technology, to measure weak magnetic fields, was used in large scale during the Second World War for the detection of submarines. Due to the good sensitivity of these magnetometers, they were largely utilized in geophysics to measure the earth's magnetic field, because they were accurate enough to sense small fluctuations, being capable of measuring the perturbations derived from the presence of large amounts of underground materials such as oil or other minerals of economic value [3]. This method is useful for the measurement of fields with intensities below 1 mT with resolutions in the range 0.1-10 nT.

The fabrication of integrated devices [4] including very small ferromagnetic cores, using materials with high permeability, low coercive force, low magnetostriction and a wide range of possible frequency operation was the technological ground for the construction of new devices. Nowadays, fluxgate magnetometers are used in different fields, being of special mention their utilization aboard spacecrafts to monitor the outer earth magnetic shield or in more remote zones of the solar system [5], in electronic compasses, and to replace SQUIDs in biomedical applications [6].

II. OPERATION PRINCIPLE

Different designs of fluxgate devices can be found in the specialized literature. Our setup uses the configuration represented in Fig.1, whose behavior is easy to understand. Two equal ferromagnetic longitudinal cores of permalloy form this structure. Each core has one winding with N1 coils. A second winding with N2 coils embraces the two cores. A sine wave alternate excitation current i_{ex}, of frequency f_0 and rms-value I_{ef}, is injected in the lower windings with opposite magnetization effect. An external dc magnetic field H_0 affects equally the two cores. The magnetizing effect of the field H_0 acts differently in the two cores.

In the case of a non-vanishing field H_0, a voltage u_0 will be detected, which contains even harmonics of the excitation frequency f_0.