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Software design to apply in thermal lens tests for spectroscopic detection of contaminant species, Iron Oxide II

Jaime Hugo Puebla Lomas[1] Raúl Kevin Monteón Valdés[2] Juan Carlos Martínez Díaz[3]

Professor and Head, Systems Engineering Department $(ESCOM - IPN)$

M.Sc. Student Systems Engineering Department $(ESCOM - IPN)$

Assistant Professor, Systems Engineering Department $(ESCOM - IPN)$

Summary: This article presents the design of software for controlling the amplitude and frequency modulation. The main reason for controlling the amplitude is because Iron Oxide II is an element found in some drinking water pipelines.One of the most demanding techniques for detecting contaminant species is the thermal lens. This paper presents only the design of the system that will have the function of controlling the modulation of one of the laser diodes, in this case the laser looks the conducting pumping laser beam will impinge on the wáter sample which contains the Iron II (FeO), but is important to note that this technique works with one second beam of another laser diode which deflects due to the wavelength in which the element to be detected (Iron II) responds to fluctuations of the laser beam pumping

Keywords - *Control, Laser diode, Modulation, Software*.

I. INTRODUCTION

Spectroscopy technique thermal lens can be applied for detection of traces of a solute in a sample, which can be, for example, a contaminant. The technique is based on having a light beam modulated in intensity or pulsed (called a pumping beam) that can be absorbed by the species to be detected. The periodic heating resulting from the absorption of light causes changes in the refractive index of the sample, which causes changes in the intensity of a continuous light beam called the test beam. The amplitude of the intensity changes is proportional to the concentration of the absorbing species. In these applications it is important to avoid the interference generated by other polluting species. One of the solutions is alternating light sources of pumping of different wavelengths following a certain pattern of modulation, subject that will approach this project. As usually diode lasers are used as pump sources, it leads us to develop an automatic modulation control of these devices. In Figure 1 the integration of the electronic system is presented for controlling modulation of the laser diodes, the modulation is done properly by the software which will be in charge of modulating the sample.

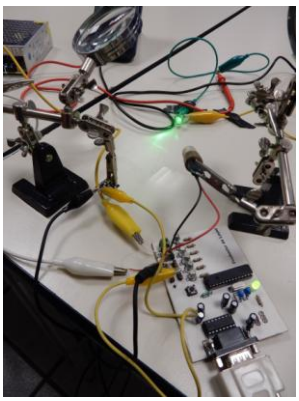

Figure 1. Control system for the modulation of laser diodes.

II. SYSTEM DESIGN TO MODULATION CONTROL IN LASER DIODES.

The importance of this work focus in the use of free software, whose purpose is not dependent on proprietary software which is very expensive such as LabVIEW software by National Instruments and whose employment is very common in many laboratories where photothermic techniques are studied.In the system design parameters, they were considered the parameters to be controlled; such as modulation and optical intensity of the laser diode, this because by each case of contaminant specie, there is a response in amplitude and phase with respect to frequency.Part of the electronic design is based on the characteristics of the laser diode, specifically its wavelength [1], transmission power and electrical characteristics of each laser diode [2]. One of the key parameters for electronic card design modulation control, is the optical power that emits the laser diode and the current to which this leads in time to be polarized as a function of this current starts the laser diode response.The control board must be considering the frequencies will be modulated by each laser diode, this because the wavelengths are different depending on the present contaminating species in the water. For our case study we have in Figure 2, the representation of the excitation curve of the Ferrous Oxide. Curves (a, a') and (b, b') correspond to transitions derived from other research focused on synthesis and characterization.

For the case study we are interested in observing the curve corresponding to the excitation wavelength of $\lambda = 484nm$, to apply thermal lensing technique for spectroscopic detection of contaminant species.

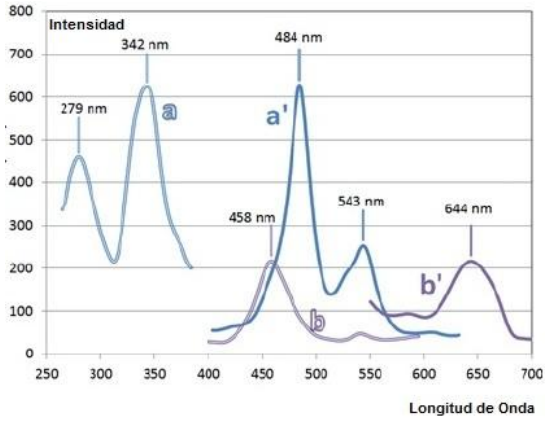

Figure 2. Excitation curve Ferrous Oxide (FeO.) [3]

Also it´s important to note that the flowchart of system development has a sequence which is related to the actual operation of the system. In this flowchart describes the steps that define the logic of the software that is focused on the modulation in amplitude and frequency. On the Figure 4 we have the symbols representing the flowchart our system

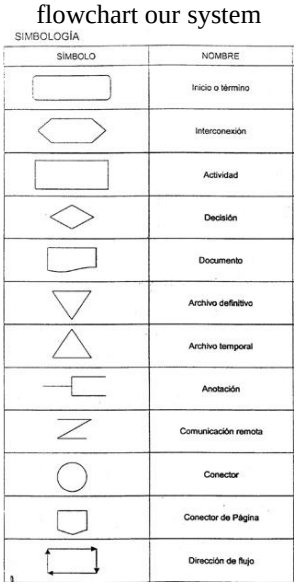

Figure 4. Symbology to generate the system flowchart.

The next Figure 5 represents the development system with flowchart diagram.

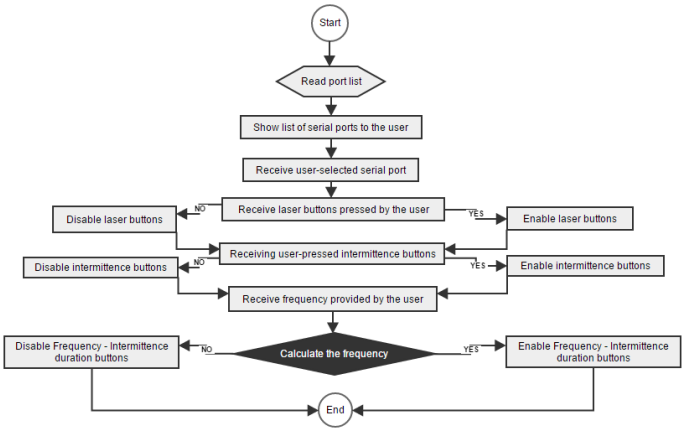

Figure 5. System flowchart.

III. CONTROL MODULATION SYSTEM INTERFACE

Finally, it presented in Figure 6 the interface that controls the modulation in amplitude and frequency. This interface selects the ports available and open communication between hardware and software, to subsequently select manually the laser diode to modulate or done automatically, so the automatic selection of buttons allows you to use intermittently frequencies for the laser diode modulation.

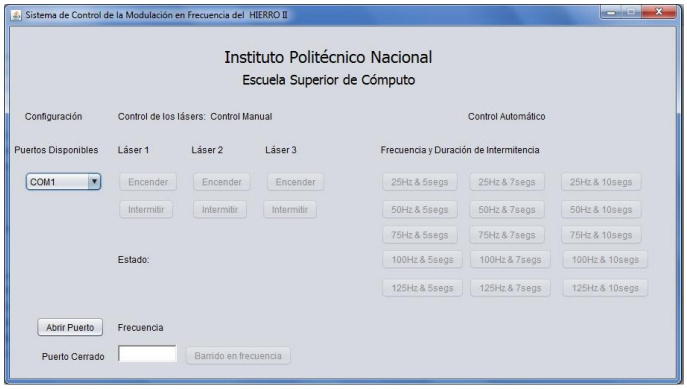

Figure 6. Interface of the control system of modulation laser diode.

IV. CONCLUSIONS

We can conclude that the development of free software systems is increasingly more employment because it has the flexibility in this application, it means that any area of engineering requires a system; such as roduction processes, automatic control of pneumatic, hydraulic, electrical systems, etc.Finally, the development of this system allows testing experiments of thermal lensing for spectroscopic detection of contaminant species.

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