

Real Time Monitoring Of Lubricating Oil Properties Using LabVIEW

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Abstract— This project is demonstration of parameters of lubricating oil such as viscosity, acid content on real time basis made use of LabVIEW. This project is essentially related to a variety of fields comprising of designing, fabrication, electronics and graphical programming and since these topics are closely related to the academic curriculum it would enhance our knowledge in the field of Mechatronics and Engineering Tribology. For this project, we have built a prototype based on the BFW Pump in Zuari Agro Chemicals Limited, Zuarinagar - Goa. The prototype can be used as a laboratory setup in the Mechatronics laboratory in our college Don Bosco College of Engineering, Fatorda - Goa; to demonstrate oil parameters measurement. As such the students will get an opportunity to practically work on the setup and understand the functions of LabVIEW. The main objective of this project is to achieve a simple function of measuring parameters of fluid. We have used oil in this setup but it can be used for any other fluids by making minor modifications accordingly. The viscosity of a fluid can be very critical in many industries like where lubrication of some machines is very critical, Industrial chemistry, Web coating, Food industry (fermented milk or cream), Polymer processing like injection moulding, compression moulding, blow moulding where the viscosity of the liquid polymer is important so that the final product obtains the required shape and properties, As such can be very useful in improving the efficiency of the processes.

Index Terms— LabVIEW, Viscosity, pH, DAQ.

I. INTRODUCTION

This work aims to monitor the parameters of lubricating oil that affects the performance of hydrodynamic journal bearing. This project aims to develop a prototype to monitor the parameters of lubricating oil using virtual instrumentation software LabVIEW 8.5. Hydrodynamic journal bearings are vital component in all rotary machines; hence their study

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becomes very important. Under normal operating conditions bearing undergoes significant change in performance parameters because of change in the temperature of the lubricant and other parameters of the machine in which they are installed. In conventional processes, oil monitoring is done manually through different laboratory tests in order to find the different properties of the lubricating oil. Conventional process is time consuming and tedious work for the analysts and difficult to be applied in industry. Online data acquisition is must to ensure the reliability of the data.

A. LabVIEW

LabVIEW which stands for Laboratory Virtual Instrument Engineering Workbench, is software developed by National Instruments. This is graphical programming software which is capable of automating an entire system. This includes data acquisition, data presentation and taking the required corrective action. It helps engineers scale from design to test and from small to large systems. It offers unprecedented integration with existing legacy software, IP, and hardware while capitalizing on the latest computing technologies. LabVIEW provides tools to solve today's problems and the capacity for future innovation faster and more effectively. NI LabVIEW offers unparalleled integration with NI and third-party data acquisition hardware, signal processing libraries, and user interface controls built for measurement data visualization. LabVIEW can be used to develop measurement systems faster, automate multiple measurements, and make data-driven decisions.

B. Effects on hydrodynamic journal bearing

Viscosity: - When the temperature of the oil increases, the viscosity decreases. Because of which the oil film thickness reduces and there can be metal to metal contact thus affecting the performance of hydrodynamic journal bearing. When the temperature is too high the bonding between the cast iron layer and white metal is affected. Superficial melting and flow of bearing material, especially with bearing materials like white metal. These may be due to inadequate, overheating or insufficient oil supply.

Acid content: -The acidic products are usually organic in nature and mineral or inorganic acids are normally absent in the oil unless oil contamination or degradation has taken place. Such acidity, in lubricating oils is normally not allowed to develop in excess of 1.5 mg KOH/gm. and much less in case special oils like spindle oils, turbine oils and HLP grade hydraulic oil, etc.

II. OVERVIEW OF THE PROJECT

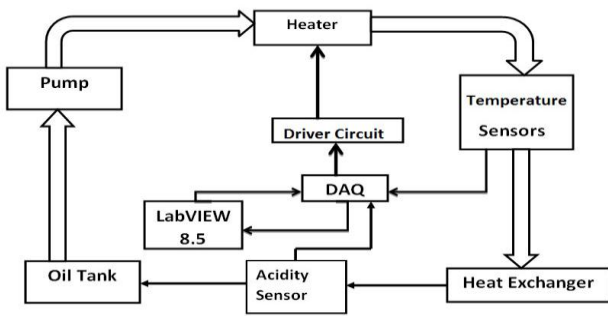


Figure 1: Block Diagram of Setup

Used oil sample of the BFW pump setup from the Zuari Industries is taken, the oil sample will be transferred to the oil tank. From the oil tank, the pump which is installed just after it will pump the oil to the heater. The heater will increase the temperature of the lubricating oil to its requisite temperature. Since the working temperature of the oil is between 40°C to 80 °C we have installed a driver circuit to switch ON/OFF the heater between that ranges. Two sensors are installed just next to the heater. The purpose of installation of temperature sensor is to find the viscosity of the oil for different temperature ranges. In order to maintain the optimum properties of the lubricating oil, the oil is discharged to the heat exchanger to drop its temperature below its working temperature. From the heat exchanger, the oil is discharged to the oil tank. In between we have installed one acid sensor, which will give the pH values of the oil. From the oil tank, the oil is pumped by the pump and the cycle continues.

III. OVERVIEW OF AUTOMATION

A. Signal conditioning

Signal conditioning can include amplification, filtering, converting, range matching, isolation and any other processes required to make sensor output suitable for processing after conditioning. The output signal from the sensor of a measurement system has generally to be processed in some way to make it suitable for the next stage of the operation. This signal may be too small and have to be amplified, contain interference which has to be removed, be non - linear and require linearization, be analogue, be a resistance change and have to be made into a current change. All these changes can be referred to as signal conditioning. For example, the output from a thermocouple is a small voltage, a few millivolts. A signal conditioning module might then be used to convert this into a suitable size current signal, provide noise rejections, linearization and cold junction compensation.

B. Signal conditioning circuit

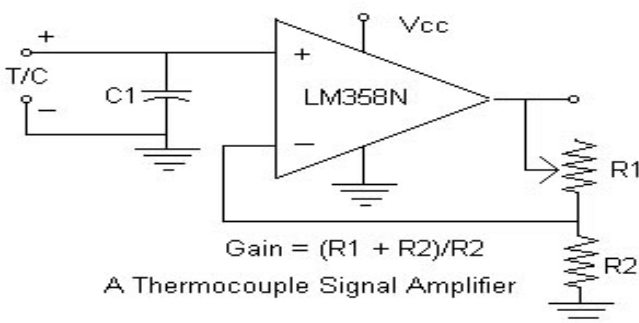


Figure 2: Temperature Circuit

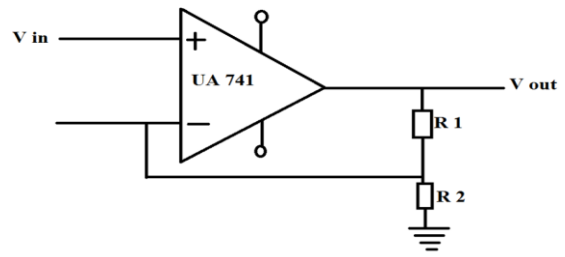


Figure 3: pH Circuit

C. Programming with LabVIEW

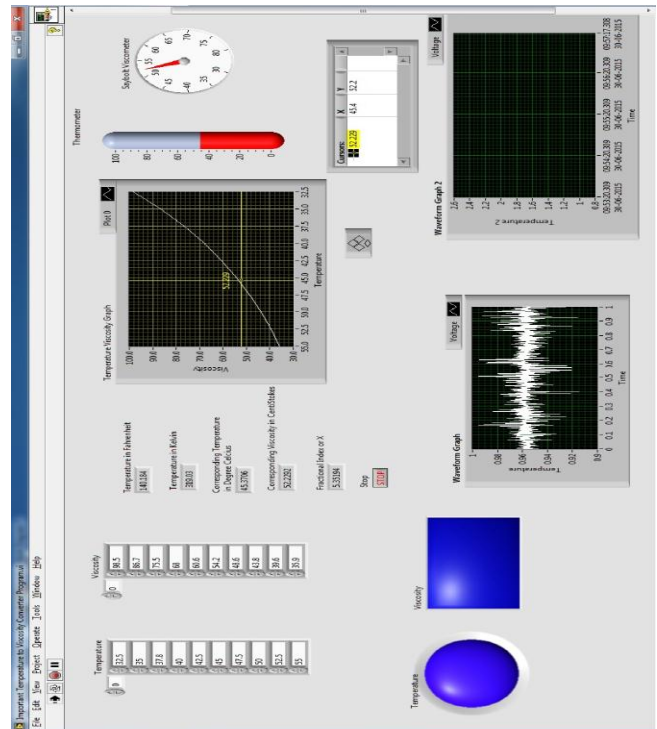


Figure 4: Temperature Programme

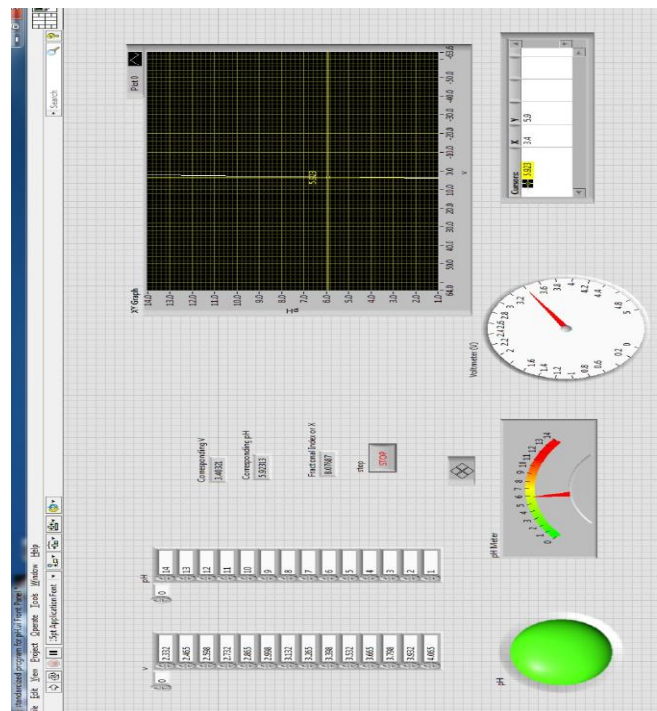


Figure 4: pH Programme

IV. RESULT AND DISCUSSION

• Table I: Analytical Report Of Oil Sample (Zuari Agro Chemicals Limited Laboratory)

SAMPLE	VISCOSITY	ACIDITY
SERVO PRIME 68	REDWOOD SECONDS	MGS. OF KOH/GM
FRESH OIL	324	0.05
USED OIL	352	0.05

• Table II: Analytical Report Of Oil Sample (From Process Equipment In Mechatronics Laboratory)

SAMPLE	VISCOSITY	VISCOSITY	ACIDITY
SERVO PRIME 68	REDWOOD SECONDS	CENTISTOKES	PH
FRESH OIL	307	79.81	5.87
USED OIL	331	86.05	5.95

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V. CONCLUSION

- This project can be used to develop Neural Network Model for predicting the remaining life of Lubricating oil
- This project can be applicable to chemical, fertilizer, pharmaceuticals, food industry, Steam power plants etc.
- This project can be used as test rig for determining the properties of lubricating oil in journal bearings.

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