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Application of Electronics to Fibre Testing Instruments in Textile

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ABSTRACT: The electronics techniques have entered through many fields. In textile industry many electronic components are used and many instruments and machines are fitted with electronic measurement techniques. In this paper, fibre testing instruments fitted with electronic components are discussed. How those instruments are working could be found from electronics literature. They are presented in this paper. Hygrometer fibre identification, fibre length measurement, fibre fineness testing, fibre maturity testing, fibre strength measurement, trash measurement are done with electronic instruments. How they are working is presented here. Using these techniques hard calculations are avoided and quick results are obtained. Study of these techniques can be included in the syllabus of new students & it will enhance the knowledge and understanding of subjects & unnecessary training in industry could be lessened.

KEYWORDS: PLC, Thermocouple, Charts, Load cell, Ultrasonic, Vibration, Polarised light, Imaging system.

I. INTRODUCTION

In this paper i.e Textile industry is one of the ancient industries which came into existence along with the mankind. As we all know that during the beginning of Middle Ages humans used to spin and weave cotton using needle and thread. This industry took a giant leap during the industrial revolution during last century and changed the way of spinning and weaving cloths. But these changes remain steady for more than a century until it became a subject for scientific study or need for designing the machines that can complete the complicated tasks of cloth spinning, fabric designing, production etc. automatically and more efficiently. The latest developments in the field of Electronics made it possible to achieve greater efficiency through the electronics machines. Today's textile industry is focusing on implementing these latest technologies in all the sectors of textile industry to increase the efficient production at lesser prices. This is given in reference [1].

II. PROGRAMMABLE LOGIC CONTROLLER (PLC)

A Programmable Logic Controller, or PLC, is a ruggedized computer used for industrial automation. These controllers can automate a specific process, machine function, or even an entire production line.

How does a PLC work?

The PLC receives information from connected sensors or input devices, processes the data, and triggers outputs based on pre-programmed parameters.

Depending on the inputs and outputs, a PLC can monitor and record run-time data such as machine productivity or operating temperature, automatically start and stop processes, generate alarms if a machine malfunctions, and more. Programmable Logic Controllers are a flexible and robust control solution, adaptable to almost any application.

What is a PLC? – Programmable Logic Controller

A **Programmable Logic Controller**, also called a **PLC** or programmable controller, is a computer-type device used to control equipment in an industrial facility.

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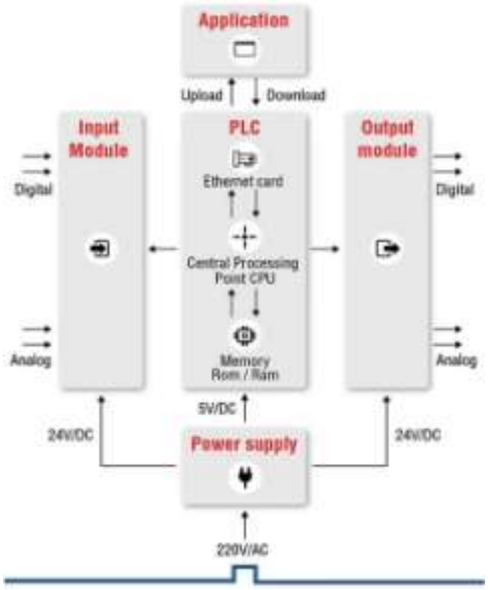
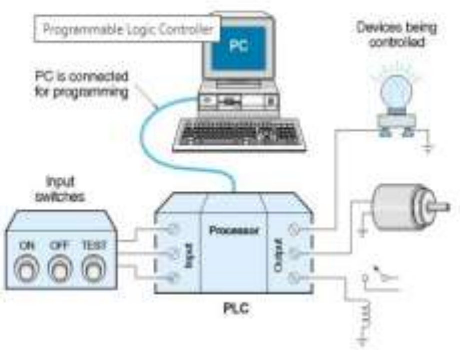
The kinds of equipment that PLCs can control are as varied as industrial facilities themselves. Utility Plants, Batch Control Application, Chemical



Programmable Logic Controller (PLC)



In a traditional industrial control system, all control devices are wired directly to each other according to how the system is supposed to operate. In a PLC system, however, the PLC replaces the wiring between the devices.

Thus, instead of being wired directly to each other, all equipment is wired to the PLC. Then, the control program inside the PLC provides the "wiring" connection between the devices.

The control program is the computer program stored in the PLC's memory that tells the PLC what's supposed to be going on in the system. The use of a PLC to provide the wiring connections between system devices is called softwiring.

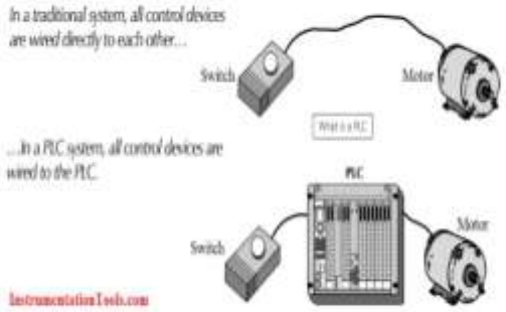
Processing, Conveyor systems, food processing machinery, auto assembly lines etc…you name it and there's probably a PLC out there controlling it.

EXAMPLE

Let's say that a push button is supposed to control the operation of a motor.

In a traditional control system, the push button would be wired directly to the motor. In a PLC system, however, both the push button and the motor would be wired to the PLC instead.

Then, the PLC's control program would complete the electrical circuit between the two, allowing the button to control the motor.



The soft-wiring advantage provided by programmable controllers is tremendous.

In fact, it is one of the most important features of PLCs. Soft-wiring makes changes in the control system easy and cheap.

If you want a device in a PLC system to behave differently or to control a different process element, all you have to do is change the control program.

In a traditional system, making this type of change would involve physically changing the wiring between the devices, a costly and time-consuming endeavour. This is given in reference [3].

In textile instruments many PLC are employed and the working of the instruments is made easy with digital output. In this paper testing of fibres are done using the modern electronic equipments. These are analysed and given here.

III. TESTING OF FIBRES

The various types of instruments used in textile industry for fibres are given in reference [2]. The modern developments are given in reference [4]. How they are working is a great mystery. The working and circuit of some instruments are analysed and presented in the following paper.

1. Working of wet & dry bulb hygrometer, velocity, moisture content modern development

The relative humidity measurement in digital form is present in the internet. Here temperature is measured.

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Instruments to measure temperature can be divided into separate classes according to the physical principle on which they operate. The main principles used are:

- The thermoelectric effect
- Resistance change
- Sensitivity of semiconductor device
- Radiative heat emission
- Thermography
- Thermal expansion
- Resonant frequency change
- Sensitivity of fibre optic devices
- Acoustic thermometry
- Colour change
- Change of state of material.

Thermocouple types

The five standard base-metal thermocouples are chromel-constantan (type E), iron-constantan (type J), chromel-alumel (type K), nicrosil-nisil (type N) and copper-constantan (type T). These are all relatively cheap to manufacture but they become inaccurate with age and have a short life. In many applications, performance is also affected through contamination by the working environment. To overcome this, the thermocouple can be enclosed in a protective sheath, but this has the adverse effect of introducing a significant time constant, making the thermocouple slow to respond to temperature changes. Therefore, as far as possible, thermocouples are used without protection.

Thermocouple manufacture

Thermocouples are manufactured by connecting together two wires of different materials, where each material is produced so as to conform precisely with some defined composition specification. This ensures that its thermoelectric behaviour accurately follows that for which standard thermocouple tables apply. The connection between the two wires is effected by welding, soldering or in some cases just by twisting the wire ends together. Welding is the most common technique used generally, with silver soldering being reserved for copper-constantan devices.

Digital thermometer

Thermocouples are also used in digital thermometers, of which both simple and intelligent versions exist. A simple digital thermometer is the combination of a thermocouple, a battery-powered, dual slope digital voltmeter to measure the thermocouple output, and an electronic display. This provides a low noise, digital output that can resolve temperature differences as small as 0.1°C. The accuracy achieved is dependent on the accuracy of the thermocouple element, but reduction of measurement inaccuracy to ±0.5% is achievable. This is given in reference [5].

Using the temperature measured in thermocouple for wet bulb and dry bulb, the difference & calculations are done by PLC and output digitally displayed.
Anemometer uses thermal mass flow measurement which is used to measure velocity, air flow, temperature & humidity using the PLC.

Thermal mass flow measurement

Thermal mass flow meters are primarily used to measure the flow rate of gases. The principle of operation is to direct the flowing material past a heated element. The mass flow rate is inferred in one of two ways, (a) by measuring the temperature rise in the flowing material or (b) by measuring the heater power required to achieve a constant set temperature in the flowing material. Typical measurement uncertainty is ±2%.

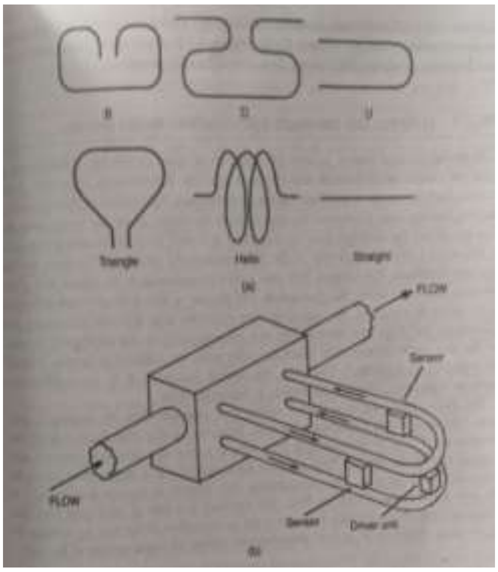

Figure (a) Coriolis flowmeter shapes, (b) detail of U-shaped Coriolis flowmeter

Joint measurement of volume flow rate and fluid density

Before the advent of the Coriolis meter, the usual way of measuring mass flow rate was to compute this from separate, simultaneous measurements of the volume flow rate and the fluid density. In many circumstances, this is still the cheapest option, although measurement accuracy is substantially inferior to that provided by a Coriolis meter.

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Volume flow rate

Volume flow rate is an appropriate way of quantifying the flow of all materials that are in a gaseous, liquid or semi-liquid slurry form (where solid particles are suspended in a liquid host), although measurement accuracy is inferior to mass flow measurement as noted earlier. Materials in these forms are carried in pipes and various instruments can be used to measure the volume flow rate. This is given in reference [5].

Analog hygrometer measuring temperature and humidity is done and displayed clearly.

Analogue meters

Analogue meters are relatively simple and inexpensive and are often used instead of digital instruments, especially when cost is of particular concern. Whilst digital instruments have the advantage of greater accuracy and much higher input impedance, analogue instruments suffer less from noise and isolation problems. In addition, because analogue instruments are usually passive instruments that do not need a power supply. this is often very useful in measurement applications where a suitable mains power supply is not readily available. Many examples of analogue meter also remain in use for historical reasons.

Analogue meters are electromechanical devices that drive a pointer against a scale. They are prone to measurement errors from a number of sources that include inaccurate scale marking during manufacture, bearing friction, bent pointers and ambient temperature variations. Further human errors are introduced through parallax error (not reading the scale from directly above) and mistakes in interpolating between scale markings. Quoted inaccuracy figures are between ±0.1% and ±3%. Various types of analogue meter are used as discussed below.

Moving-coil meters

A moving-coil meter is a very commonly used form of analogue voltmeter because of its sensitivity, accuracy and linear scale, although it only responds to d.c. signals. As shown schematically in Figure , it consists of a rectangular coil wound round a soft iron core that is suspended in the field of a permanent magnet. The signal being measured is applied to the coil and this produces a radial magnetic field. Interaction between this induced field and the field produced by the permanent magnet causes a torque, which results in rotation of the coil. The amount of rotation of the coil is measured by attaching a pointer to it that moves past a graduated scale. The theoretical torque produced is given by:

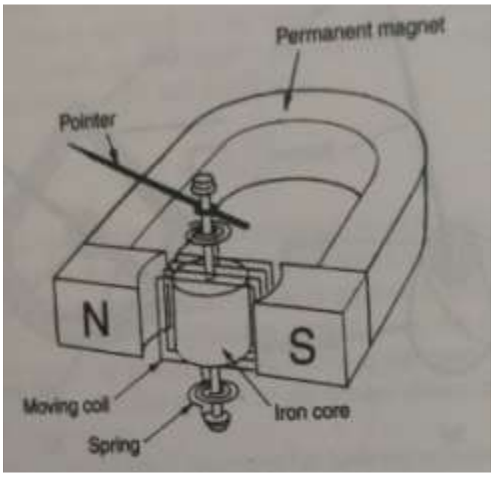

Figure Moving-coil meter

T= BIhwN ....(1)

where B is the flux density of the radial field, I is the current flowing in the coil, h is the height of the coil, w is the width of the coil and N is the number of turns in the coil. If the iron core is cylindrical and the air gap between the coil and pole faces of the permanent magnet is uniform, then the flux density B is constant, and equation (1) can be rewritten as:

T= KI ..... (2)

ie the torque is proportional to the coil current and the instrument scale is linear.

As the basic instrument operates at low current levels of one milliamp or so, it is only suitable for measuring voltages up to around 2 volts. If there is a requirement to measure higher voltages, the measuring range of the instrument can be increased by placing a resistance in series with the coil, such that only a known proportion of the applied voltage is measured by the meter. In this situation the added resistance is known as a shunting resistor.

Whilst Figure shows the traditional moving-coil instrument with a long U-shaped permanent magnet, many newer instruments employ much shorter magnets made from recently developed magnetic materials such as Alnico and Alcomax. These materials produce a substantially greater flux density, which, besides allowing the magnet to be smaller, has additional advantages in allowing reductions to be made in the size of the coil and in increasing the usable range of deflection

of the coil to about 120". Some versions of the instrument also have either a specially shaped core or specially shaped magnet pole faces to cater for special situations where a non-linear scale such as a logarithmic one is required. These are given in reference [5].
The moisture content & moisture regain % can be measured using load cell. Through PLC the values are obtained digitally.

Mass (Weight) measurement

Mass describes the quantity of matter that a body contains. Load cells are the most common instrument used to measure mass, especially in industrial applications. Most load cells are now electronic, although pneumatic and hydraulic types also exist. The alternatives to load cells are either mass-balance instruments or the spring balance.

Electronic load cell (electronic balance)

In a electronic load cell, the gravitational force on the body being measured is applied to an elastic element. This deflects according to the magnitude of the body mass. Mass measurement is thereby translated into a displacement measurement task.

2. Fibre identification working modern development

The various fibre identification charts are available for structural, physical and chemical properties in website. The sensors are available in electronics. Capacitive and resistive sensors, Magnetic sensors, Hall-effect sensors, Piezo electric transducers, strain gauges, Piezo resistive sensors, optical sensors (air path), optical sensors (Fibre-optic), Intrinsic sensors, Extrinsic sensors, Distributed sensors are available in the market.
Capacitive sensors consist of two parallel metal plates in which the dielectric between the plates is either air or some other medium. The capacitance C is given by $C = e_0 e_1$ A/d, where e_0 is the absolute permittivity, & e_1 is the relative permittivity of the dielectric medium between the plates, A is the area of the plates and d is the distance between them. Capacitive devices are often used as displacement sensors, in which motion of a moveable capacitive plate relative to a fixed one changes the capacitance. Often, the measured displacement is part of instruments measuring pressure, sound or acceleration. Alternatively, fixed plate capacitors can also be used as sensors, in which the capacitance value is changed by causing the measured variable to change the dielectric constant of the material between the plates in some way. This principle is used in devices to measure moisture content, humidity values and liquid level. These are given in reference [5].

The fibres can be used as dielectric and fibres could be identified digitally. These were not yet carried out. The identification of fibres is carried out experimentally & using charts the fibre is identified.

3. Fibre length measurement working, modern development

The ultrasonic rule consists of an ultrasonic energy source, an ultrasonic energy detector and battery-powered, electronic circuitry housed within a hand-held box. Both source and detector often consist of the same type of piezoelectric crystal excited at a typical frequency of 40 kHz. Energy travels from the source to a target object and is then reflected back into the detector. The time of flight of this energy is measured and this is converted into a distance reading by the enclosed electronics. Maximum measurement inaccuracy of ±1% of the full-scale reading is claimed.

Intelligent digital callipers are now available that give a measurement resolution of 0.01 mm and a low inaccuracy of ±0.03 mm. These have automatic compensation for wear, and hence calibration checks have to be very infrequent. In some versions, the digital display can be directly interfaced to an external computer monitoring system.

Intelligent micrometers in the form of the electronic digital micrometer are now available. These have a self-calibration capability and a digital readout, with a measure- ment resolution of 0.001 mm (1 micron). These are given in reference [5].

Using these modern measurement techniques fibre length is measured. They can be connected to computer & directly reading is found out.

In early applications of digital signal processing, the computer remained as a distinctly separate component within the measurement system. However, the past few years have seen the development of measurement systems in the form of intelligent devices in which the computational element (usually called a microcomputer or microprocessor) is much more closely integrated into the measurement system. These devices are known by various names such as intelligent instruments, smart sensors and smart transmitters.

A standard form of interface used to connect a computer to its peripheral devices is the UART (Universal Asynchronous Receiver/Transmitter). This has been used for around 30 years. A newer interface protocol that is particularly suitable for connecting large number of devices and providing for communication between different computers is the PCI (Peripheral Component Interconnect) interface. Very recently, an alternative protocol called the Universal Serial Bus (USB) has been developed that is rapidly gaining in popularity.

The raw analogue input and output signals are generally either too large or too small for compatibility with the operating voltage levels of a digital computer and they have to be scaled upwards or downwards. This is normally achieved by operational amplifiers and/or potentiometers. The main features of an operational amplifier are its high gain (typically x 1000 000) and its large bandwidth (typically 1 MHz or better). However, when one is used at very high frequencies, the bandwidth becomes significant. The quality of an amplifier is often measured by a criterion called the gain-bandwidth product, which is the product of its gain and bandwidth. Other important attributes of the operational amplifier, particularly when used in a computer input-output interface or within intelligent devices, are its distortion level, overload recovery capacity and offset level. Special instrumentation amplifiers that are particularly good in these attributes have been developed for instrumentation applications.

Intelligent Instruments

The first intelligent instrument appeared over 20 years ago, although high prices when such devices first became available meant that their use within measurement systems grew very slowly initially. The processor within an intelligent instrument allows it to apply pre-programmed signal processing and data manipulation algorithms to measurements.

One of the main functions performed by the first intelligent instruments become available was compensation for environmental disturbances to measurements that cause systematic errors. Thus, apart from a primary sensor to measure the variable of interest, intelligent instruments usually have one or more secondary sensors to monitor the value of environmental disturbances. These extra measurements allow the output reading to be corrected for the effects of environmentally induced errors, subject to the following pre-conditions being satisfied:

(a) The physical mechanism by which a measurement sensor is affected by ambient condition changes must be fully understood and all physical quantities that affect the output must be identified.
(b) The effect of each ambient variable on the output characteristic of the primary sensor must be quantified.
(c) Suitable secondary sensors for monitoring the value of all relevant environmental variables must be available that will operate satisfactorily in the prevailing environmental conditions.

Condition (a) above means that the thermal expansion and contraction of all elements within a sensor must be considered in order to evaluate how it will respond to ambient temperature changes. Similarly, the sensor response, if any, to changes in ambient pressure, humidity, gravitational force or power supply level (active instruments) must be examined.

The capabilities of smart transmitters are perhaps best emphasized by comparing the attributes of the alternative forms of transmitter available. There are three types of transmitter, analogue, programmable and smart.

(a) Analogue transmitters:
- require one transmitter for every sensor type and every sensor range
- require additional transmitters to correct for environmental changes
- require frequent calibration.

(b) Programmable transmitters:
- include a microprocessor but do not have bi-directional communication (hence are not truly intelligent)
- require field calibration.

(c) Smart transmitters:
- include a microprocessor and have bi-directional communication
- include secondary sensors that can measure, and so compensate for, environmental disturbances
- usually incorporate signal conditioning and a-d conversion
- often incorporate multiple sensors covering different measurement ranges and allow automatic selection of the required range. The range can be readily altered if initially estimated incorrectly
- have a self-calibration capability that allows removal of zero drift and sensitivity drift errors
- have a self-diagnostic capability that allows them to report problems or requirements for maintenance
- can adjust for non-linearities to produce a linear output.

These are given in reference [5].

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From the above available techniques the fibre length is directly seen in computer monitor.

4. Fibre fineness tester working modern development

The fineness of fibres is measured using light scattering method, vibration method, (Vibroscopes), Arealometer (Wheatstone bridge method).

Vibrating level sensor

The principle of the vibrating level sensor is illustrated in Figure The instrument consists of two piezoelectric oscillators fixed to the inside of a hollow tube that generate flexural vibrations in the tube at its resonant frequency. The resonant frequency of the tube varies according to the depth of its immersion in the liquid. A phase-locked loop circuit is used to track these changes in resonant frequency and adjust the excitation frequency applied to the tube by the piezoelectric oscillators, Liquid level measurement is therefore obtained in terms of the output frequency of the oscillator when the tube is resonating.

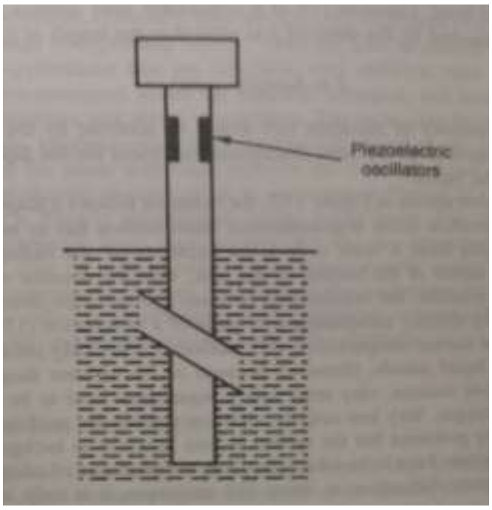

Figure Vibrating level sensor

Laser methods

One laser-based method is the reflective level sensor. This sensor uses light from a laser source that is reflected off the surface of the measured liquid into a line array of charge-coupled devices, as shown in Figure Only one of these will sense light, according to the level of the liquid. An alternative, laser-based technique operates on the same general principles as the radar method described above but uses laser- generated pulses of infrared light directed at the liquid surface. This is immune to environmental conditions, and can be used with sealed vessels provided that a glass window is provided in the top of the vessel.

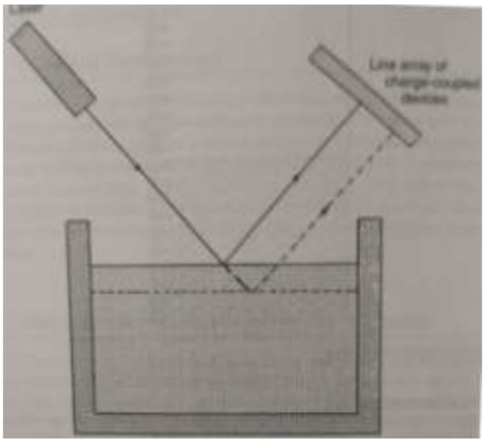

Figure Reflecting level sensor

Fibre-optic level sensors

The fibre-optic cross-talk sensor, is one example of a fibre-optic sensor that can be used to measure liquid level. Another light-loss fibre- optic level sensor is the simple loop sensor shown in Figure. The amount of light loss depends on the proportion of cable that is submerged in the liquid. This effect is magnified if the alternative arrangement shown in Figure is used, where light is reflected from an input fibre, round a prism, and then into an output fibre. Light is lost from this path into the liquid according to the depth of liquid surrounding the prism.

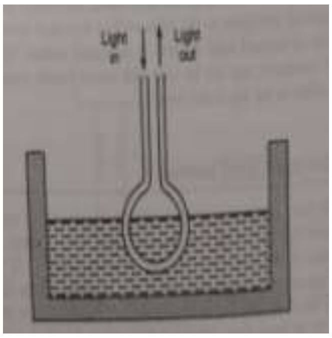

Figure. Loop level sensor

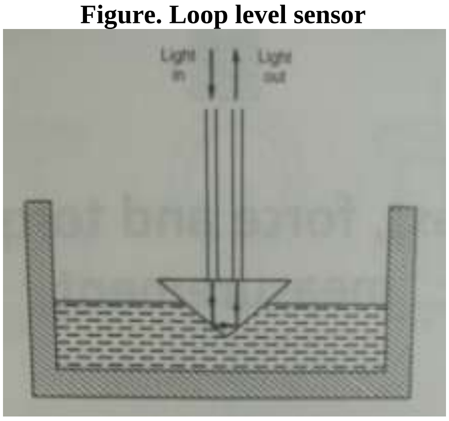

Figure. Prism level sensor

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Bridge circuits

Bridge circuits are used very commonly as a variable conversion element in measurement systems and produce an output in the form of a voltage level that changes as the measured physical quantity changes. They provide an accurate method of measuring resistance, inductance and capacitance values, and enable the detection of very small changes in these quantities about a nominal value. They are of immense importance in measurement system technology because so many transducers measuring physical quantities have an output that is expressed as a change in resistance, inductance or capacitance. The displacement-measuring strain gauge, which has a varying resistance output, is but one example of this class of transducers. Normally, excitation of the bridge is by a d.c. voltage for resistance measurement and by an a.c. voltage for inductance or capacitance measurement. Both null and deflection types of bridge exist, and, in a like manner to instruments in general, null types are mainly employed for calibration purposes and deflection types are used within closed-loop automatic control schemes. These are given in reference [5].

5. Fibre maturity measurement working modern development.

Fibre maturity can be measured using polarized light method and air permeability method in modern development instrument.

The rate at which fluid flows through a closed pipe can be quantified by either measuring the mass flow rate or measuring the volume flow rate. Of these alternatives, mass flow measurement is more accurate, since mass, unlike volume, is invariant. In the case of the flow of solids, the choice is simpler, since only mass flow measurement is appropriate.

Mass flow rate

The method used to measure mass flow rate is largely determined by whether the measured quantity is in a solid, liquid or gaseous state.
These are given in reference [5].

The various measures of measuring flow rate available are conveyor based methods, Coriolis flowmeter, Thermal mass flow measurement, Volume flow rate, differential pressure meters, orifice plate, ventnris and similar devices, pilot static tube, variable area flow meters (Rotameters), Positive displacement flowmeters, Turbine meters, electromagnetic flowmeters, Vortex-shedding flowmeters, Ultrasonic flow meters, Doppler shift ultrasonic flowmeter, Transit time ultrasonic flow meter, other types of flowmeter for measuring volume flow rate, Cross-correlation flowmeter, laser Doppler flow meter and intelligent flowmeters.
Variable area flow meters is used for fibre maturity measurement.

Variable area flowmeters (Rotameters)

In the variable area flowmeter (which is also sometimes known as a Rotameter), the differential pressure across a variable aperture is used to adjust the area of the aperture The aperture area is then a measure of the flow rate. The instrument is reliable and cheap and used extensively throughout industry, accounting for about 20% of all flowmeters sold. Normally, this type of instrument only gives a visual indication of flow rate, and so it is of no use in automatic control schemes. However, special versions of variable area flowmeters are now available that incorporate fibre optics. In these, a row of fibres detects the position of the float by sensing the reflection of light from it, and an electrical signal output can be derived from this.

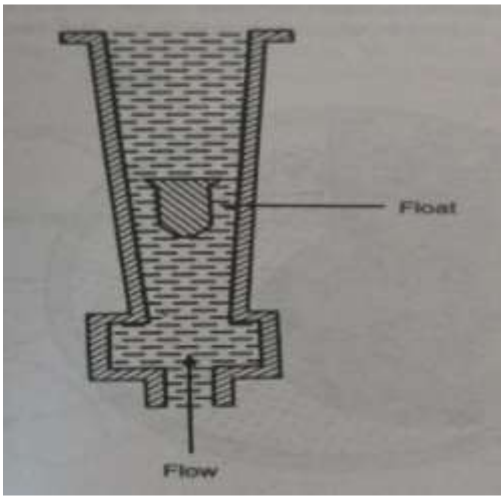

Figure. Variable area flowmeter

In its simplest form, shown in Figure. The instrument consists of a tapered glass tube containing a float which takes up a stable position where its submerged weight is balanced by the upthrust due to the differential pressure across it. The position of the float is a measure of the effective annular area of the flow passage and hence of the flow rate. The inaccuracy of the cheapest instruments is typically ±5%, but more expensive versions offer measurement inaccuracies as low as ±0.5%.
These are given in reference [5].
The values are fed through PLC and automatic maturity values are obtained. Laser Doppler flow meter is used for measuring fibre maturity.
These are given in reference [5].

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6. Fibre strength measurement working modern development

Load cell is used for fibre strength measurement. Bridge circuits are normally employed. Null type, dc bridgr (Wheatstone bridge), Deflection type dc bridge, AC bridges, null type impedance bridge, Maxwell bridge, deflection type ac bridge are used for load cells. The resistance measurement is done by various methods. DC bridge circuit, voltmeter-ammeter method, Resistance-substitution method, Digital voltmeter to measure resistance, the ohmmeter can be used for resistance measurements.

Null-type, d.c. bridge (Wheatstone bridge)

A null-type bridge with d.c. excitation, commonly known as a Wheatstone bridge, has the form shown in Figure. The four arms of the bridge consist of the unknow resistance R_u two equal value resistors R_2 and Ry and a variable resistor R_v (usually a decade resistance box). A d.c. voltage V_1 is applied across the points AC and the resistance R, is varied until the voltage measured across points BD is zero. This null point is usually measured with a high sensitivity galvanometer.

To analyse the Whetstone bridge, define the current flowing in each arm to be I_1….. I_4 as shown in Figure Normally, if a high impedance voltage-measuring instrument is used, the current I_m drawn by the measuring instrument will be very small and can be approximated to zero. If this assumption is made, then, for $I_m = 0$:

$I_1=I_3$ and $I_2=I_4$

Looking at path ADC, we have a voltage V_i, applied across a resistance $R_u + R_3$ and by Ohm's law:
$I_1= (V_i) / (R_u+R_3)$
Similarly for path ABC:
$I_2= (V_i) / (R_v+R_2)$

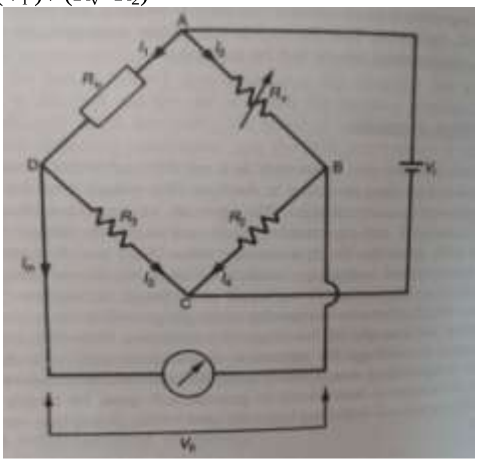

Figure Analysis of Wheatstone bridge

Now we can calculate the voltage drop across AD and AB
$V_{AD}=I_1R_v = (V_i R_u) / (R_u+R_3)$; $V_{AB}=I_2R_v = (V_i R_v) / (R_v+R_2)$
By the principle of superposition,
$V_o=V_{BD} = V_{BA} +V_{AD} = -V_{AB} + V_{AD}$

Thus:
$V_0= - \{(V_i R_v) / (R_v+R_2)\} +\{ (V_i R_u) / (R_u+R_3)\}$
At the null point $V_o= 0$, so:
$R_u / (R_u+R_3) = R_v / (R_v+R_2)$
Inverting both sides:
$(R_u+R_3) / R_u = (R_v+R_2) / R_v$
i.e $R_3 / R_u = R_2 / R_v$ or $R_u = (R_v+R_3) / R_2$
Thus, if $R_2= R_3$, then $R_u = R_v$. As R_v is an accurately known value because it is derived from a variable decade resistance box, this means that R, is also accurately known.
These are given in reference [5].
By integrating Wheatstone bridge with PLC direct values are obtained.

7. Trash measurement working modern development

The imaging system is used for measuring trash content in cotton. The imaging system is done by various methods. Cathode ray oscilloscope, cathode ray tube, channel single ended input, differential input, Time base circuit, vertical sensitivity control, display position control, digital storage oscilloscope.

Digital storage oscilloscopes

Digital storage oscilloscopes consist of a conventional analogue cathode ray oscilloscope with the added facility that the measured analogue signal can be converted to digital format and stored in computer memory within the instrument. This stored data can then be reconverted to analogue form at the frequency necessary to refresh the analogue display on the screen. This produces a non-fading display of the signal on the screen.

The signal displayed by a digital oscilloscope consists of a sequence of individual dots rather than a continuous line as displayed by an analogue oscilloscope. However, as the density of dots increases, the display becomes closer and closer to a continuous line, and the best instruments have displays that look very much like continuous trace The density of the dots is entirely dependent upon the sampling rate at which the analogue signal is digitized and the rate at which the memory contents are read to reconstruct the original signal. Inevitably, the speed of sampling etc. is a function of cost, and the most expensive instruments give the best performance in terms of dot density and the accuracy with which the analogue signal is recorded and represented

Besides their ability to display the magnitude of voltage signals and other parameters such as signal phase and frequency, some digital oscilloscopes can also compute signal parameters such as peak values, mean values and r.m.s. values. They are also ideally suited to capturing transient signals when set to single-sweep mode. This avoids the problem of the very careful synchronization that is necessary to capture such signals on an analogue oscilloscope. In addition, digital oscilloscopes often have facilities output analogue signals to devices like chart recorders and output digital signals in a form that is compatible with standard interfaces like IEEE488 and RS232. Some now even have floppy disk drives to extend their storage ability.

These are given in reference [5].
Using the imaging system and integrating with PLC accurate trash content on cotton is found out.

IV. DISPLAY, RECORDING AND PRESENTATION OF MEASUREMENT DATA

The earlier chapters in this paper have been essentially concerned with describing ways of producing high-quality, error-free data at the output of a measurement system. Having got the data, the next consideration is how to present it in a form where it can be readily used and analysed. This chapter therefore starts by covering the techniques available to either display measurement data for current use or record it for future use. Following this, standards of good practice for presenting data in either graphical or tabular form are covered, using either paper or a computer monitor screen as the display medium. This leads on to a discussion of mathematical regression techniques for fitting the best lines through data points on a graph. Confidence tests to assess the correctness of the line fitted are also described. Finally, correlation tests are described that determine the degree of association between two sets of data when they are both subject to random fluctuations.

Display of measurement signals

Measurement signals in the form of a varying electrical voltage can be displayed either by an oscilloscope or else by any of the electrical meters described earlier in Chapter 6. However, if signals are converted to digital form, other display options apurt from meters become possible, such as electronic output displays or using a computer monitor.

Electronic output displays

Electronic displays enable a parameter value to be read immediately, thus allowing for any necessary response to be made immediately. The main requirement for displays is that they should be clear and unambiguous. Two common types of character format used in displays, seven-segment and 7 x 5 dot matrix, are shown in Figure. Both types of display have the advantage of being able to display alphabetic as well as numeric information, although the seven-segment format can only display a limited nine-letter subset of the full 26-letter alphabet. This allows added meaning to be given to the number displayed by including a word or letter code. It also allows a single display unit to send information about several parameter values, cycling through each in turn and including alphabetic information to indicate the nature of the variable currently displayed.

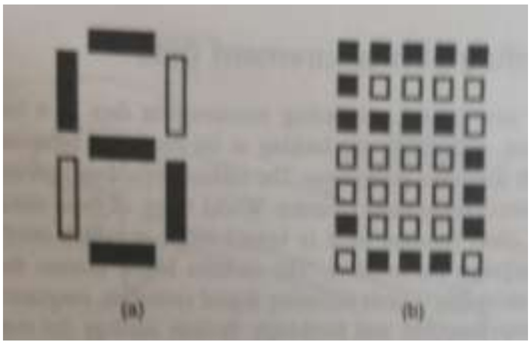

Figure. Character formats used in electronic displays: (a) seven-segment; (b) 7 x 5 dot matrix.

Electronic output units usually consist of a number of side-by-side cells, where each cell displays one character. Generally, these accept either serial or parallel digital input signals, and the input format can be either binary-coded decimal (BCD) or ASCII Technologies used for the individual elements in the display are either light-emitting diodes (LEDs) or liquid-crystal elements.

Computer monitor displays

Now that computers are part of the furniture in most homes, the ability of computers to display information is widely understood and appreciated. Computers are now both cheap and highly reliable, and they provide an excellent mechanism for both displaying and storing information. As well as alphanumeric displays of industrial plant variable and status data, for which the plant operator can vary the size of font used to display the information at will, it is also relatively easy to display other information such as plant layout diagrams, process flow layouts etc. This

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allows not only the value of parameters that go outside control limits to be displayed, but also their location on a schematic map of the plant. Graphical displays of the behaviour of a measured variable are also possible. However, this poses a difficulty when there is a requirement to display the variable's behaviour over a long period of time since the length of the time axis is constrained by the size of the monitor's screen. To over- come this, the display resolution has to decrease as the time period of the display increases.

Touch screens are the very latest development in computer displays. apart from having the ability to display the same sort of information as a conventional computer monitor, they also provide a command-input facility in which the operator simply to touch the screen at points where images of keys or boxes are displayed. A full ‘qwerty’ keyboard is often provided as part of the display. The sensing elements behind the screen are protected by the glass and continue to function even if the glass gets scratched. Touch screens are usually totally sealed, and thus provide intrinsically safe operation in hazardous environments.

Recording of measurement data

Many techniques now exist for recording measurement data in a form that permits subsequent analysis, particularly for looking at the historical behaviour of measured parameters in fault diagnosis procedures. The earliest recording instruments used were various forms of mechanical chart recorder. Whilst many of these remain in use, most modern forms of chart recorder exist in hybrid forms in which microprocessors are incorporated to improve performance. The sections discuss these, along with other methods of recording signals including digital recorders, magnetic tape recorders, digital (storage) oscilloscopes and hard-copy devices such as dot-matrix, inkjet and laser printers.

Mechanical chart recorders

Mechanical chart recorders are a long-established means of making permanent records of electrical signals in a simple, cheap and reliable way, even though they have poor dynamic characteristics which mean that they are unable to record signals at frequencies greater than about 30 Hz. They have particular advantages in providing a non-corruptible record that has the merit of instant 'viewability', thereby satisfying regulations in many industries that require variables to be monitored and recorded continuously with hard-copy output. ISO 9000 quality assurance procedures and ISO 14000 environmental protection systems set similar requirements, and special regulations in the defence industry go even further by requiring hard-copy output to be kept for ten years. Hence, whilst many people have been predicting the demise of chart recorders, the reality of the situation is that they are likely to be needed in many industries for many years to come. This comment applies particularly to the more modern, hybrid form of chart recorder, which contains a microprocessor to improve performance. Mechanical chart recorders are either of the galvanometric type or potentiometric type. Both of these work on the same principle of driving chart paper at a constant speed past a pen whose deflection is a function of the magnitude of the measured signal. This produces a time history of the measured signal. These are given in reference [5].

The various types of display of measurement signals are electronic output displays, computer monitor displays, mechanical chart recorders, galvanometric recorders, potentiometric recorders, circular chart recorders, ultraviolet recorders, fibre optic recorders, hybrid chart recorders, magnetic tape recorders, digital recorders, storage oscilloscopes.

After obtaining the values the presentation of data is done. Various presentation types are tabular data presentation, graphical presentation of data, fitting curves to data points on a graph, regression techniques, linear least squares regression, polynomial least squares regression, correlation tests.

V. RESULTS AND DISCUSSIONS

Using electronics for instruments makes the testing accurate and large calculations are automatically done using PLC designs. The role of electronics to textiles is presented. The discussion on PLC is given & its understanding is done clearly. The working of humidity measurements instrument is given. Fibre identification charts given in internet are discussed. Fibre length measurement is given & its connection to computer is explained. Fibre fineness tester working is clearly understood. Fibre maturity measurement using modern techniques are given. Fibre strength measurement is given & it is clearly understood. Trash content of cotton measurement using modern instruments working is given. These are not in the present syllabus of curricula, of textile students. But industries uses only these modern instruments. So necessary steps to introduce these techniques to curriculum of textile students should be taken to cater the need of textile industry.

VI. CONCLUSION

Various new modern instruments uses electronic techniques & computers which gives accurate results with less time and less labour work. To have good quality of product modern techniques should be employed. Students should be taught with modern techniques in polytechnics and colleges.

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