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Aims and Scope

Journal of Electrical engineering and Modern Technology, publishes original research papers in the fields of Electrical and Electronic Engineering and in related disciplines. Areas included (but not limited to) are electronics and communications engineering, electric energy, automation, control and instrumentation, computer and information technology, and the electrical engineering aspects of building services and aerospace engineering, Journal publishes research articles and reviews within the whole field of electrical and electronic engineering, new teaching methods, curriculum design, assessment, validation and the impact of new technologies and it will continue to provide information on the latest trends and developments in this ever-expanding subject.

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Contents

Run-Time Management for Multicore Embedded Systems with Energy Harvesting (Solar Energy)

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ABSTRACT

Through energy harvesting system, new energy sources are made available immediately for many advanced applications based on environmentally embedded systems. However, the harvested power, such as the solar energy, varies significantly under different ambient conditions, which in turn affects the energy conversion efficiency. There are two approach for designing power-adaptive computing systems to maximize the energy utilization under variable solar power supply, which I will b discussing in this paper. First paper ―Power Adaptive Computing System for Solar-Energy-Powered Embedded Systems‖ uses the power adaptive computing systems to maximize the energy utilization under variable solar power supply. Here the geometric programming technique is exploited which can generate a customized parallel computing structure effectively. Second paper ―Run-Time Management for Multicore Embedded Systems With Energy Harvesting‖ proposes a novel semidynamic algorithm (SDA)-based framework with energy budgeting that manages energy and workload allocation at runtime for multicore embedded systems with solar energy harvesting capability.

I. INTRODUCTION

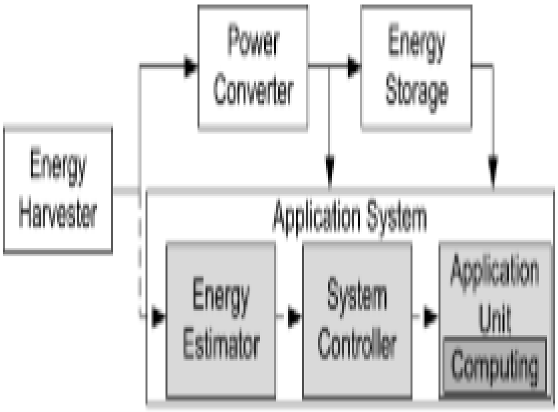

Figure 1 : Energy harvesting embeded system model.

Energy harvesting powered system needs to adapt to the unstable nature of the ambient energy. Power adaptability optimizes the system behavior according to the changing external power supply and thus allows the system to work in a long duration [5]. Fig. 1 shows a model of the energy harvesting embedded systems [1], [2]. The energy harvester converts ambient energy to electricity. The power converter extracts power from the harvester and performs ac–dc or dc–dc conversion with the goal of transferring as much power as possible to the energy storage or application system. The energy storage buffers the harvested energy temporally and supplies energy to the application system, the embedded application-specific functional unit. If the harvested energy exceeds the energy consumed by the application system, the system is powered directly by the harvester and the surplus will charge the energy storage.

The design goal of the power-adaptive computing systems is to maximize the system performance, under the constraint that the power consumption does not exceed the amount of power supply available. This constraint is also known as the energy neutral mode [5], where the energy consumption rate has to match with the availability of the power supply.

$$\begin{array}{ll} \min & T_{\text{exe}}(\vec{x}) \\ \text{s.t.} & P_c(\vec{x}) \leq P_s(t) \\ & T_{\text{exe}}(\vec{x}) \leq T_{\text{req}} \quad \textbf{\textit{(P1)}} \end{array}$$

where $Pc(x\,)$ is system power consumption, $Texe(x\,)$ is system execution time, $Treq$ is execution time requirement, and $Ps(t)$ is system power supply changing over time. *(p1)* means that the system can run as fast as possible, while the power consumption constraint is not violated.

II. ADAPTIVE POWER MANAGEMENT

The basic idea of these approaches is to switch the system to different operation modes according to different workloads. The target applications of these approaches are those with varying run-time workloads. the target of the power-adaptive computing systems is the application scenarios, where the power supply varies over time. the systems with varying power supply have a more demanding design requirement. Works on adaptive power management in energy harvesting systems were presented in [2], [5]. There are two key elements for the adaptive power management: power modulation technique and power adaptation strategy. While the power adaptation strategies determine when and in which mode a system should work according to the harvested energy, the power modulation techniques regulate the system power consumption so that a system can work in multiple power modes.

Power modulation techniques such as duty cycling, dynamic voltage and frequency scaling (DVFS), power gating, and clock gating are widely used. Duty cycling changes the active time of the system components to adjust the power consumption. The DVFS technique controls system power consumption by adjusting the supply voltage and frequency. High-priority tasks execute with the required voltage and frequency. Through enabling/disabling functional units and their clock sources, clock gating technique regulates the system power consumption. These three techniques affect only the system dynamic power profile. The power gating technique modulates both the dynamic and static power by powering ON/OFF parts of the systems. According DVFS and power gating introduce time delay between power mode transitions. In addition, DVFS has a limited dynamic range due to the system operational restrictions on clock frequencies and supply voltages. Power gating implemented on the top of clock gating can further increase the power modulation range, leading to more effective power-adaptive approach.

III. COMPUTING UNIT

In the computing structure, system operations were divided into three steps: data input, computation, and data output. In the data input step, operand data processed by all Pus were loaded into corresponding on-chip memories from the off-chip global memory. Each datum was loaded only once. In the computation step, all PUs with the same functionality processed different data in parallel. The structure of PUs was customized for the target applications, and operations in each PU were pipelined. In the output step, computation results were transferred back to the off-chip memory. All three steps were pipelined. Parallel computing structure was defined based on the geometric programming technique. the peak power of the harvested solar energy, was considered to ensure the designed computing unit work reliably in that environment. Here the execution of the parallel computing system is a pipelining of data input, computation, and data output. Each processing units performs only arithmetic computation and could contain adders/subtracters, multipliers or comparators for the target applications and only access its own local memory

IV. RUN-TIME MANAGEMENT USING SDA

In the second paper the author Yi Xiang propose a novel semidynamic algorithm (SDA)-based framework with energy budgeting that manages energy and workload allocation at runtime for multicore embedded systems with solar energy harvesting capability. The novelty and main contributions of this paper are summarized as follows.

1) SDA reacts to runtime energy shortages and fluctuations proactively to find greater scope for energy savings, especially in multicore platforms.
2) A hybrid energy storage system is designed to decouple the runtime management scheme from variations in energy harvesting, as well as to enhance charging/discharging efficiency.
3) The energy and task distribution heuristics in SDA take system heterogeneity into consideration by assigning workloads with an awareness of variations due to within-die process variations.
4) At the core level, a novel dual-speed frequency selection method is deployed to combine two neighboring discrete frequency levels for superior energy efficiency with an awareness of vol tage/frequency switching overhead.
5) This framework cooperates with basic throttling mechanisms to tackle processor overheating.

In addition, it dynamically reallocates workload or shuts down cores for more proactive multilevel throttling to reduce the occurrences and overhead of system overheating. Overheating the systems leads to the sudden shutdown or some application may not work or run properly, this framework handles overheating intelligently.

V. SYSTEM MODEL

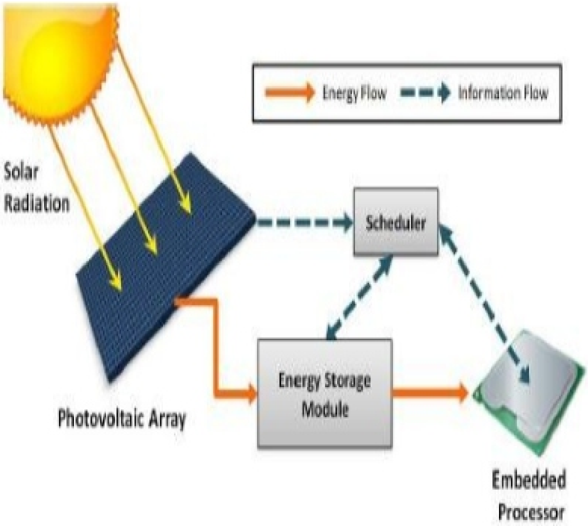

Fig.2. Real-Time embedded processing with solar energy harvesting.

A PV array is used as a power source for our embedded system, converting ambient solar energy into electric power. Naturally, the amount of harvested power varies over time due to changing environmental conditions, like angle of sunlight incidence, cloud density, temperature, and humidity. To cope with the unstable nature of the solar energy source, rechargeable batteries and supercapacitors can be used to buffer solar energy collected by PV cells. The capacity of the energy storage device is limited and harvested energy will be wasted if the energy storage device is already fully charged. We consider an embedded system with a low power multicore processor that has a support for task preemption. We assume that the frequency of each core can be adjusted individually (i.e., the processor possesses per-core DVFS capability).

The utilization of a periodic task (U) is defined with respect to the full speed (maximum frequency) provided by the processor. A task's utilization is its execution time under the maximum frequency divided by its period.

$$U_i = \frac{C_i / f_{\max}}{T_i}.$$

P2

The utilization for an entire task set is simply the accumulation of the utilization for all the tasks in the set. In preemptive real-time systems, a task set is schedulable by the EDF algorithm for a frequency j if it meets the following condition:

$$U_{\text{total}} \le \frac{f_j}{f_{\max}}. \quad \textbf{(P3)}$$

we consider thermal management in an energy harvesting multicore processing environment. We assume that each core in the multicore processor has a digital thermal sensor (DTS) implemented to monitor runtime temperature independently. We set 85 °C as the thermal setpoint at which throttling is initiated to halt all processor executions (i.e., throttling threshold = 85 °C). When throttling is triggered, a core must halt execution and shift to idle state until its temperature drops to 80 °C.

Run-Time scheduler module is an important component of the system for information gathering and execution control. The scheduler dynamically gathers information by monitoring the energy storage medium and multicore processor state (Fig. 2). The gathered data, together with offline- profiled information about task execution times and energy consumption on cores informs a management algorithm in our scheduler that coordinates operation of the multicore platform at runtime. Each core is eventually assigned strategy by the scheduler to guide intracore task execution.

VI. SEMIDYNAMIC ALGORITHM OVERVIEW

One of the underlying ideas behind SDA is to exploit time segmentation during energy management. At each specified time interval, there is a reschedule point, where the execution strategy can be adjusted based on the energy budget provided by the energy storage system. A time frame between two reschedule points is called a schedule window, within which the strategy specified at the prior reschedule point is in effect until the next reschedule point. Thus, reschedule points provide dynamic adaptively needed by the energy harvesting aware system to adjust the task execution strategy, while the schedule window enables stable execution that utilizes periodic task information for better energy efficiency. It can be observed that under low energy conditions, SDA maintains execution at an optimal low (critical) frequency with different number of cores activated. Cores only execute at higher frequency when the energy harvested is abundant. In this manner, SDA can provide a better execution efficiency to improve performance under variable solar radiance conditions.

At each reschedule point, we update the execution strategy for the upcoming schedule window with a rescheduling scheme composed of three stages.

1) **Energy Budgeting:** This stage estimates the energy budget available for the upcoming schedule window based on the status of the hybrid energy storage system. Estimating the energy budget decouples runtime system management from energy variations in the environment, making it possible to deduce a stable balanced execution strategy that maximizes energy efficiency.

2) Workload Estimation: This second stage evaluates the amount of workload that can be supported by the energy budget and forks into two separate paths.

3) Task Rejection and Allocation: Based on the amount of workload estimated by the previous stage, this stage takes the periodic task set and filters out the subset of tasks that are less important. The remaining tasks are accepted for execution and are allocated to cores with an awareness of core heterogeneity.

VII. HYBRID ENERGY STORAGE SYSTEM

hybrid energy storage system and its management policy, determines the energy budget for the upcoming schedule window, thereby isolating runtime task scheduling from fluctuations in solar energy harvesting.

The proposed hybrid energy storage system with one Li-ion battery and two separate super capacitors connected by a dc bus. During each schedule window, one capacitor is used to collect energy extracted from the PV array, while the other one is used as a power source for system operation or battery charging. At each reschedule point, the two super capacitors switch their roles. Super capacitors charge the battery only when their saved energy exceeds the peak requirements of processors running at full speed.

The PV array, battery, and super capacitors are coupled with bidirectional dc–dc converters to serve the purpose of voltage conversions between components with maximum power point tracking and voltage level compatibility. This hybrid battery and dual-supercapacitor design has several advantages over a nonhybrid system.

1) The super capacitors can support embedded processors directly, taking advantage of a much lower charging/ discharging overhead compared with a battery.
2) The electrochemical battery offers high capacity to preserve energy especially in scenarios with excessive harvested energy. On the other hand, the capacity requirement of super capacitors is much smaller.
3) The super capacitor with energy buffered during the last schedule window acts as a known stable energy source for the system in the upcoming schedule window. Thus, our energy budgeting does not require energy harvesting power predication.

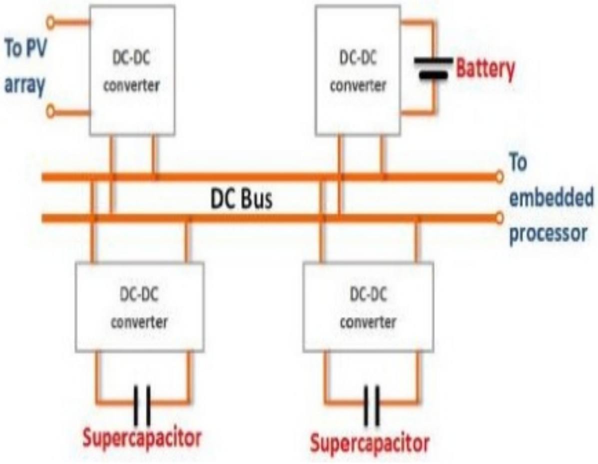

Figure 3 : Hybrid energy storage system

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Lightning Acquisition and Basic Triggering using Kintex-7 FPGA

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ABSTRACT

In this paper, the basic continuous acquisition of a Lightning signal at the rate of 1 MS/sec has been performed , as well as the time stamping of the acquired signal using the GPS module has been performed on the Lightning Sensor Node. The time stamping has been carried out to determine the Lightning location using the 'Time of Arrival' Technique in the further Sferic detection algorithms. The entire implementation has been carried out in real time using the cRIO-9030 controller. The process of data acquisition as well as the time stamping using the GPS module has been carried out on the Kintex-7 FPGA . The cRIO is used to handle the communication to the PC using an Ethernet. Further a triggering algorithm has also been implemented based on Amplitude thresholding on the FPGA. The implementation details along with the obtained results have been summarized in this paper.

Keywords - Sferic, FPGA to RT DMA FIFO, Kintex-7 FPGA, Cloud to Ground Lightning, cRIO, Network Streams

1. INTRODUCTION

This paper primarily focuses on the acquisition of the negative Cloud to Ground Lightning and development of the Digital Section of the Lightning Sensor Node. The Lightning Sensor Node currently has a Cross Magnetic Loop Antenna developed by [6] and a 'B' field analog front end of the lightning receiver developed by [5]. In this paper the focus is on the implementation of the data acquisition along with the triggering algorithm. The triggering is based on the threshold value which is determined by the noise level at the site location, this threshold parameter has been used as an input to trigger the data acquisition. The acquisition in the currently developed system is a continuous data acquisition and all the buffers and memory elements have been efficiently handled on the FPGA as well as the cRIO controller, as a result there is no data loss while acquiring the data values and the time stamps from the FPGA .

The data acquired in real time from the FPGA can then in future be used to trigger the further Sferic processing blocks on the FPGA . The further Sferic processing algorithms would then be applied on the FPGA and the final confirmed data would then be transmitted in the form of frames from the FPGA to the cRIO and later to the PC using Network Streams. Ethernet has been used to transmit data from the cRIO to the PC . This paper focuses on the Data Acquisition, Time Stamping and the triggering algorithm which have been implemented on the FPGA . The paper also shows the communication of the data from the cRIO to the PC, as all the data points have been logged on the PC using the TDMS file format.

2. DESIGN ARCHITECTURE

This section explains the design details for the implementation which has been carried out on the FPGA. The design details have already been explained in detail in [1][2]. The important tasks which have been identified for the current implementation on the FPGA are as follows: Data Acquisition and Time stamping on the FPGA, Triggering algorithm based on the Amplitude Thresholding carried out on the FPGA. The design details for the current implementation on the cRIO has been discussed in detail by [1][2] .The cRIO has been used to only reconstruct the data and transfer the live data to the PC using Ethernet. The PC is used to store the data points along with the time stamps and also the live data has been plotted on the PC using Graph indicators in Labview . The implementation details for the basic triggering logic has been shown in the below flow chart.

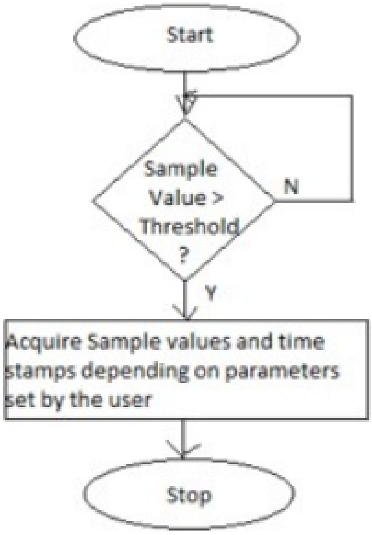


FIG 2.1. FLOW CHART FOR BASIC TRIGGERING

2.1. Significance of Basic Triggering

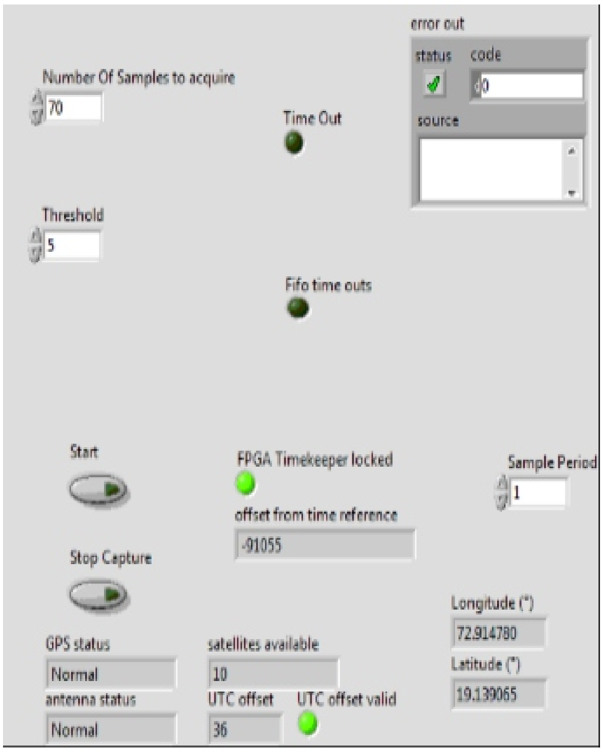
The current implementation is used to acquire data continuously for long period of time . The triggering based on the noise level is the very first step to trigger the acquisition . In this case it's a very efficient technique to optimize the resources on the FPGA since the data is not continuously transmitted, as the threshold is being checked continuously prior to transmitting the data . In case of a negative lightning event , if the data lies below the threshold for a long time the FPGA does not waste its resources to buffer the unwanted data and transmit , it still checks once the data goes above threshold atleast once and in such cases the acquisition is being triggered and the data according to the number of data points to be acquired along with the relevant time stamp is being transmitted from the FPGA to the cRIO using FPGA to RT DMA FIFO . This helps in removal of the unwanted data at an early step of the Sferic detection.

3. RESULTS AND DISCUSSION

The lightning signal is a pulse train[8] , due to the current climatic situation this pulse train was generated using a set of available hardware components as discussed in [1]. The generated pulse train is as shown in Fig. 3.1

FIG 3.1. GENERATED PULSE TRAIN

The pulse train shown in Fig 3.1 has been fed as an input to the channel 0 of the NI 9223 ADC module using the BNC connector . The Fig 3.1 shows the pulse train plot as observed on the Digital Storage Oscilloscope. The Front panel controls on the FPGA used to carry out the Basic Triggering algorithm has been shown in Fig 3.2



error out
status ✓ code 0
source

Number Of Samples to acquire 70

Threshold 5

Sample Period 1

offset from time reference -91055

Longitude (°) 72.914780

Latitude (°) 19.139065

GPS status Normal

antenna status Normal

satellites available 10

UTC offset 36

FIG 3.2. FRONT PANEL CONTROLS ON THE FPGA- BASIC TRIGGERING

In the above Front Panel the control parameters are the 'Number Of Samples to acquire', 'Threshold' and the 'Sample Period'. The Acquisition is triggered by pressing the Start button once the 'FPGA Timekeeper Locked' Led has been lit up . The acquisition can be stopped by pressing the 'Stop Capture' button.

The results obtained after applying the basic triggering logic , as observed on the PC is shown in Fig.3.3

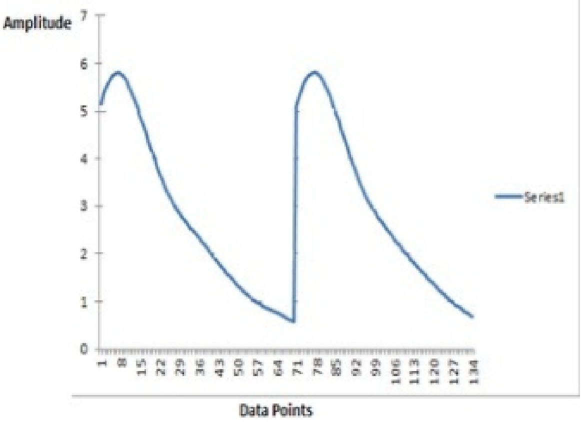


FIG 3.3. GRAPHICAL PLOT OF DATA CAPTURED ON THE PC

The Fig.3.3 shows the graphical plot of the data logged on the PC in a TDMS file format. The data values along with the time stamps logged on the PC is shown in Table 3.1

TABLE 3.1: LOGGED DATA VALUES AND TIME STAMPS

5.15299987	18:39 447778us
5.35415649	18:39 447779us
5.518127441	18:39 447780us
5.647171021	18:39 447781us
5.736434937	18:39 447782us
5.787857056	18:39 447783us
5.80305481	18:39 447784us

The Table 3.1 shows the logged values and the time stamps after converting it into UTC. In Fig 3.2 , the control parameters set on the FPGA show that the threshold has been set to 5 and the Number of Samples to acquire has been set to 70 , which indicates that the signal is triggered if its amplitude exceeds 5 volt and post trigger seventy samples are to be acquired which is equivalent to a data of seventy microseconds, considering the situation that data is time stamped in microseconds. The electromagnetic signature of lightning has already been captured by Haddad et.al. [7]. The characteristic also includes the pulse width of the negative Cloud to Ground lightning signal. This can be used as a reference to set the Number of Samples to acquire and this parameter would be in microseconds as each sample is acquired with a microseconds time stamp, after the threshold has been crossed. The implementation of the algorithm is clear from Fig 3.3 where the acquisition is triggered once the 5 V is crossed and later seventy data points are acquired as shown in Fig 3.2 and observation from the plot. The system again waits till the next threshold is crossed once again the acquisition has been triggered and later seventy data points have been acquired. Since the number of Samples to acquire has been set to seventy by the user, however, it can be set to any value depending on the total pulse width of the typical negative Cloud to Ground Lightning.

3.1. ADVANTAGES OF THE IMPLEMENTED BASIC TRIGGERING ALGORITHM

The significance of the triggering algorithm is efficient data acquisition for long period of time because the system waits till the trigger point is crossed before acquiring the sample values along with the time stamp. This helps in efficient data acquisition as there is no storage of data on the FPGA . Hence, there is no buffer overflow on the FPGA[3][4].This leads to efficient usage of the memory and also allows data logging for longer period of time. The limited data can now be sent to the further Sferic processing blocks on the FPGA to implement the further Sferic processing algorithms in order to determine the data as a valid lightning data chunk.

4. CONCLUSION

The current implementation is able to acquire the negative Cloud to Ground lightning within a frequency range of 3 – 30 Khz . The basic triggering algorithm which has been applied is based on the threshold value set by the user. The threshold value is currently a user defined parameter .This parameter can be made adaptable by implementing the adaptable threshold value by averaging the sample values when the signal stays below the threshold. The current analog section of the Sensor Node is designed to work within a frequency range of 3-30 Khz[5]. The system can be made adaptable in future to work at 1 Mhz frequency, also the digital section can be implemented with the sampling rate of atleast 10 MS/sec, in order to accurately represent the sharp rise times and signal transitions of a Cloud to Ground Lightning signal.

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Concert Study of Four Wave Mixing Optical Fiber and its Application

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ABSTRACT

Four-wave mixing (FWM) is a occurrence that must be evade in DWDM transmission, but depending on the application it is the basis of significant second- generation optical devices and optical device extent technology. This paper converse the theory of FWM, and then introduces one of its applications --a broadband all-optical concurrent wavelength converter urbanized using a high nonlinearity dispersion fiber (HNL-DSF).

That competently produces FWM. The concurrent wavelength exchange of two different formats or bit-rate optical signals, with low input power, is established in a highly nonlinear optical fiber with a single strong continuous-wave pump. The effect of four-wave mixing at highly nonlinear optical fiber is analyzed at 1 km distances with its power.

Keywords: vector theory, conservation of fibre

I. INTRODUCTION

When a high-power optical signal is commence into a fiber, the linearity of the optical response is lost. One such nonlinear effect, which is due to the third-order exciting vulnerability, is called the optical Kerr effect. Four-wave Mixing (FWM) is a type of optical Kerr effect, and occurs when light of two or more diverse wavelengths is beginning into a fiber. Normally speaking FWM occurs when light of three dissimilar wavelengths is launched into a fiber, giving rise to a new wave (know as an idler), the wavelength of which does not coincide with any of the others. FWM is a kind of optical parametric oscillation.

In the broadcast of dense wavelength-division multiplexed (DWDM) signals, FWM is to be passing up, but for certain applications, it gives an effective technological basis for fiber- optic devices. FWM also provides the basic technology for measuring the nonlinearity and chromatic dispersion of optical fibers. This paper discusses those aspects of R & D into FWM applications that the authors have carried out recently in connection with broadband all- optical simultaneous wavelength conversion and a technique for measuring the nonlinear coefficient of optical fibers.

$$fiddler = fp1 + fp2 - probe$$

Where: fp1 and fp2 are the pump light frequencies, and f-probe is the frequency of the probe light. This condition is called the frequency phase-matching condition. When the frequencies of the two pumping waves are identical, the more specific term "degenerated four-wave mixing" (DFWM) is used, and the equation for this case may be written where: fp is the frequency of the degenerated pumping wave.

Continuous-wave DFWM may be expressed by the following nonlinear coupled-mode equations

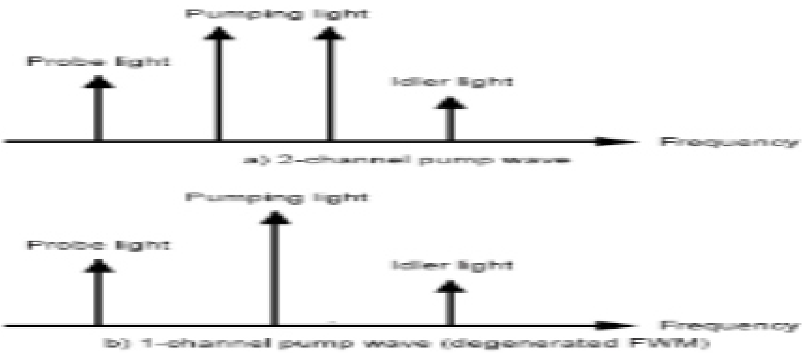

Figure 1 : Schematic of four - wave mixing in the frequency domain

$$\frac{dE_{\mathrm{p}}}{dz}+\frac{1}{2}\alpha E_{\mathrm{p}}=\mathrm{i}\gamma\left(\left|E_{\mathrm{p}}\right|^{2}+2\left|E_{\mathrm{probe}}\right|^{2}+2\left|E_{\mathrm{idler}}\right|^{2}\right)E_{\mathrm{p}}+2\mathrm{i}\gamma\ E^{*}{}_{\mathrm{p}}E_{\mathrm{probe}}E_{\mathrm{idler}}\exp(\mathrm{i}\Delta\beta\ z)$$

$$\frac{dE_{\mathrm{probe}}}{dz}+\frac{1}{2}\alpha E_{\mathrm{probe}}=\mathrm{i}\gamma\left(\left|E_{\mathrm{probe}}\right|^{2}+2\left|E_{\mathrm{idler}}\right|^{2}+2\left|E_{\mathrm{p}}\right|^{2}\right)E_{\mathrm{probe}}+2\mathrm{i}\gamma\ E^{*}{}_{\mathrm{idler}}E_{\mathrm{p}}{}^{2}\exp(-\mathrm{i}\Delta\beta\ z)$$

$$\frac{dE_{\mathrm{idler}}}{dz}+\frac{1}{2}\alpha E_{\mathrm{idler}}=\mathrm{i}\gamma\left(\left|E_{\mathrm{idler}}\right|^{2}+2\left|E_{\mathrm{p}}\right|^{2}+2\left|E_{\mathrm{probe}}\right|^{2}\right)E_{\mathrm{idler}}+2\mathrm{i}\gamma\ E^{*}{}_{\mathrm{probe}}E_{\mathrm{p}}{}^{2}\exp(-\mathrm{i}\Delta\beta\ z)$$

------------------------*EQ-1*

Where: z is the longitudinal coordinate of the fiber, a is the attenuation coefficient of the fiber, and Ep, Eprobe and Eidler are the electric field of the pumping, probe and idler waves. g is the nonlinear coefficient, and is obtained by 1) where: n2 is the nonlinear refractive index, Affiance is the effective area of the fiber and c is the speed of light in a vacuum.

II. VECTOR THEORY OF FOUR-WAVE MIXING:

A whole portrayal of dual-pump FOPAs should include all parametric processes invent from deteriorate+-- -as well as no worsen FWM.In most untried situations, the two pumps are positioned symmetrically 30–40 nm away from the zero-dispersion wavelength of the fiber.5–7 The resulting gain band exhibits a central flat region in which the leading donation comes from a single no degenerate FWM process corresponding to v1 1 v2! vs. 1 vi, where v1, v2, vs., and vi are the optical frequencies of the two pumps, signal, and idler, respectively. Other FWM processes affect wings of the gain band but leave its flat portion unchanged. Since the flat part is used in practice, we focus only on the above no worsen process in the following analysis. Furthermore, we neglect pump .Assuming that the instantaneous electronic response dominates and neglecting the Raman contribution, we find that the third- order nonlinear polarization in a medium such as silica glass is given by

$$\mathbf{P}^{(3)}(\mathbf{r},\ t)\ =\ \epsilon_{0}\overset{\leftrightarrow}{\chi}{}^{(3)}\vdots\mathbf{E}(\mathbf{r},\ t)\mathbf{E}(\mathbf{r},\ t)\mathbf{E}(\mathbf{r},\ t),$$

III. THEORETICAL CONSIDERATIONS:

Dissemination of optical pulses in single-mode optical fibers is explain by the well-known nonlinear Schro ¨dinger equation

$$\frac{\partial U}{\partial Z}+\frac{\beta^{(2)}}{T_0^2}\frac{\partial^2 U}{\partial \tau^2}=i\gamma P_0|U|^2U,$$

Where U is the complex electric field wrapper normalized to the absolute amplitude of the field P0^2, P0 is the total power in the fiber, t is time normalized to the pulse width and measured in a reference frame moving with the group velocity of the pulse $[\tau=(t-z/v_g)/T_0]$, $T_0$is the pulse width, And b (2) is the group velocity spreading and is given by the second-order unoriginal of b, the axial wave vector, with respect to the angular frequency Wave The nonlinearity coefficient is given by the relationship

$$\gamma=\frac{\omega_{\mathrm{ave}}n_2^1}{cA_{\mathrm{eff}}},$$

IV. POLARIZATION-DEPENDENT ON NATURE OF FOUR-WAVE MIXING:

Here, we examine the polarization-dependent nature of FWM inside optical fibers. The vector FWM equations can be used in the general case in which the pumps and the signal are launched into the optical fiber with arbitrary SOPs. However, to examine the association between the FWM efficiency and the pump polarizations as simply as possible. Physically, the polarization-dependent nature of FWM inside optical fibers stems from the requirement of angular-momentum conservation among the four interacting photons in an isotropic medium. This requirement can be described most simply in a basis

$$\frac{d\mathcal{U}_i}{dz}=i\beta_i\mathcal{U}_i+\frac{4i\gamma}{3}[\mathcal{U}_1\mathcal{U}_2\mathcal{U}_s^*+(\mathcal{U}_1\mathcal{D}_2+\mathcal{D}_1\mathcal{U}_2)\mathcal{D}_s^*],$$

(

$$\frac{d\mathcal{D}_i}{dz}=i\beta_i\mathcal{D}_i+\frac{4i\gamma}{3}[\mathcal{D}_1\mathcal{D}_2\mathcal{D}_s^*+(\mathcal{U}_1\mathcal{D}_2+\mathcal{D}_1\mathcal{U}_2)\mathcal{U}_s^*].$$

in which *"and denote* left and right circular polarization states and carry the intrinsic angular momentum respectively.

4.1. Consequence of Wavelength Converters:

Wavelength converter is simply a device for converting the injected signal light from one wavelength to another. It therefore is seen to have great promise in configuring the photonic networks of the future using optical cross connect. A number of methods of wavelength conversion have been proposed, of which parametric conversion using optical fiber FWM offers two major advantages: high conversion speed and the ability to effect simultaneous conversion of signals within a wavelength bandwidth.

4.2. Wavelength Conversion in the Fiber:

The most important characteristics desired of wavelength converters using parametric conversion are high conversion efficiency and broad bandwidth. To achieve this kind of wavelength conversion, the following conditions must be met:

(a) Pump wavelength must coincide with zero-dispersion wavelength;

(b) Chromatic dispersion variation in the longitudinal direction of the fiber should be minimized; and

(c) States of polarization of the pump and signals must coincide.

V. EXTENT OF NONLINEAR COEFFICIENT AND CHROMATIC DISPERSION:

5.1. Nonlinear Coefficients:

The explosive growth in long-haul telecommunications achieved in recent years has been largely attributable to DWDM technology and the role played by EDFAs, but the nonlinear effects of signals amplified by EDFAs have resulted in the degradation of system performance.

Attention has recently been focused on dispersion managed systems as a means of suppressing FWM. Reverse-dispersion fiber (RDF) is used in combination with conventional single-mode fiber (SMF). 16) At 1550 nm, RDF has a chromatic dispersion of the same magnitude as SMF but of opposite sign (normal dispersion), and the dispersion slope is reversed. Thus it can compensate for both dispersion and dispersion slope simultaneously.

A number of methods have been developed for measuring the nonlinear coefficient g, including the use of self phase modulation, cross-phase modulation and four waves mixing. In the present paper a technique was considered that was applicable to a comparatively wide normal dispersion domain, and yet measurements could be carried out by all-optical means. This was because it was realized that as dispersion-managed systems become more widely used and the demand for RDF and other fiber having normal dispersion increases, so will the need to evaluate it.

5.2. Principles of Extent:

Let us discuss measurement in terms of the pump undeleted approximation proposed by Stolen and Bornholm, which in the case of DFWM is accomplished by Equation. This is an approximation in which the attenuation coefficient of Equation is zero and the pumping power is taken to be so large as to be dominant. For this reason the pumping light is not subject to DFWM-induced reaction. The signal light and idler light are of about the same magnitude, and interact together through DFWM.

$$\frac{dE_{\mathrm{p}}}{dz} = \mathrm{i}\gamma \left|E_{\mathrm{p}}\right|^{2} E_{\mathrm{p}}$$

$$\frac{dE_{\mathrm{probe}}}{dz} = 2\mathrm{i}\gamma \left|E_{\mathrm{p}}\right|^{2} E_{\mathrm{probe}} + 2\mathrm{i}\gamma E^{*}{}_{\mathrm{idler}} E_{\mathrm{p}}{}^{2} \exp(-\mathrm{i}\Delta\beta z)$$

$$\frac{dE_{\mathrm{idler}}}{dz} = 2\mathrm{i}\gamma \left|E_{\mathrm{p}}\right|^{2} E_{\mathrm{idler}} + 2\mathrm{i}\gamma E^{*}{}_{\mathrm{idler}} E_{\mathrm{p}}{}^{2} \exp(-\mathrm{i}\Delta\beta z)$$

Solving Equation analytically, conversion efficiency Gc in the normal dispersion domain of the fiber may be Represented 1) as

$$G_{\mathrm{c}} = \gamma^{2} P_{\mathrm{p}}{}^{2} L^{2} \left[\frac{\sin(gL)}{gL} \right]^{2}$$

Where in g is termed parametric gain, and can be obtained by

$$g \equiv \sqrt{\frac{1}{4} \Delta\beta (\Delta\beta + 4\gamma P_{\mathrm{p}})}$$

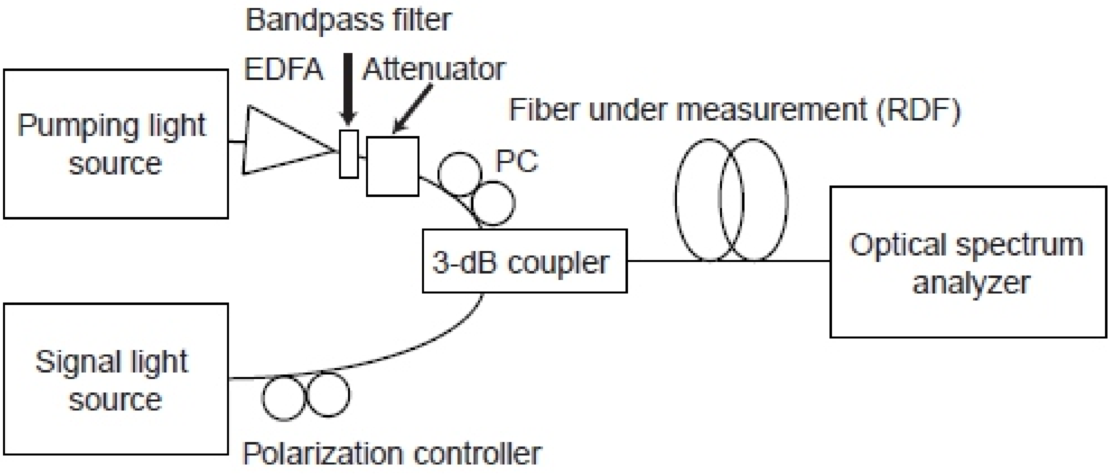

Figure 2 : Setup for simultaneous measurement of nonlinear coefficient and chromatic dispersion

VI. CONCLUSION:

In this paper the we have discuss method for realize broadband all-optical simultaneous wavelength conversion by taking advantage of four-wave mixing (FWM) occurring in the fiber, together with techniques for the simultaneous measurement of the nonlinear coefficient and chromatic dispersion.

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Causes and Impacts of Protection Failure Due to Power Distribution System

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ABSTRACT

The distribution system is commonly broken down into three components: distribution substation, distribution primary and secondary. At the substation level, the voltage is reduced and the power is distributed in the smaller amounts to the customers. Consequently, one substation will supply many customers with the electric power. Thus, the number of the transmission lines in the distribution systems is many times that of the transmission systems. Furthermore, most customers are connected to only one of the three phases in the power distribution system. Therefore, the flow of the power on each of the lines is different and the system is typically 'unbalanced'. The electrical components in the power distribution systems are divided into six groups including overhead lines, underground lines, protective equipments, power transformers, distribution transformers, and capacitors. The failure of power distribution system may be due to failure of distribution transformers, mechanical damages, electrical circuits, magnetic circuits etc. that may lose the protections.

1. INTRODUCTION

The purpose of an electrical power generation system is to distribute the energy to a multiplicity of the points for diverse applications [1]. The system should be designed and managed to deliver this energy to the utilization points with the high reliability and adequate economy [2]. Reliability can be defined as the probability that a device or a system will perform a given task under the specified environmental condition for a specific period of time, while availability is that, a system will be able to perform its required function over a specific period of the time [3].

The distribution system is commonly broken down into the three components: distribution substation, distribution primary and secondary [4]. At the substation level, the voltage is reduced and the power is distributed in the smaller amounts to the customers. Consequently, one substation will supply many of the customers with the electric power. Thus, the number of the transmission lines in the distribution systems is many times that of the transmission systems. Furthermore, most of the customers are connected to only one of the three phases in the distribution system. Therefore, the flow of the power on each of the lines is different and the system is typically 'unbalanced'.

The main function of the electrical power distribution systems is to provide power to the individual consumer premises [5]. Distribution of the electric power to different consumers is done with much low voltage level. Distribution of the electric power is done by the distribution networks. Distribution networks for the power supply consist of following main parts:

1. Distribution substation
2. Primary distribution feeder
3. Distribution Transformer
4. Distributors
5. Service mains

Often it is found the failure due to some of the faults in the Power Distribution System. The fault prediction for the failure in the Power Distribution System based on the early identification of symptoms, or incipient faults, leading to the appearance of faults is a topic of interest in power systems and several frameworks are available. The failure in the Power Distribution System often comes due to several causes those are transformer problem, mechanical damages, electrical circuits, magnetic circuits, lighting etc.

2. FAILURE OF POWER DISTRIBUTION SYSTEM

2.1. Transformer Breakdown

Transformers are one of the most important components of a distributed power system and can pose a lot of complicacies if they breakdown. Transformer problems normally are caused by the insulation oil degradation, overload, thermal stress, humidity in oil/paper and bushing defective and etc. [6]. Though the voltage transients and faults can impose a lot of stress on the transformers and its windings, overloading the transformer seldom leads to a breakdown. However, they can considerably weaken the thermal insulation and accelerate the ageing process of the transformers. From the records it may be stated that some of the causes are due to the contaminated oil. This is when they contain the moisture or other foreign substances that are not products of oil oxidation. One or a combination of the following can cause the elevated temperature: excessive load, excessive ambient temperature, cooling system problems, sludge oil, dark coloured exterior paints. Load and ambient temperature are closely related in their effect on the transformer operating temperature [7]. For the constant transformer load, the higher ambient temperature led to higher operating temperature. A number of the cooling system problems can cause a high operating temperature: closed radiator valves, dirty cooling fins, broken or improperly set cooling fans/pumps, and the cooling control circuit failure [8].

FIGURE 1: TRANSFORMER BREAKDOWN

Excessive heat in a transformer can invariably weaken the insulating materials, making it brittle over a period of time, before it finally breaks it. For every 10°C rise in the temperature, the proximity of a thermal breakdown, also known as "Monstinger Factor," almost doubles resulting in the rapid ageing of the transformer. Also, once the insulation gets a brittle enough and the fault current flows through the windings, they literally shake and get cracked down. This in turn may lead to the transformer breakdown.

It should also be noted that even in the liquid filled transformers, extreme hot-spot temperatures can result in transformer failure [9]. The reason being, hot-spots are prone to generate the air bubbles, which are capable of decreasing the dielectric strength of the insulating liquid in the transformer leading to its failure [10].

2.2. Mechanical Damage in Transformer

Following are the causes of mechanical damages in Transformer:

1. The welding of the main tank may be defective and also the fillings may not be leak proof. This causes oil to leak reducing the oil level in the transformer causing heating of the winding and leading to a certain break-down of the equipment. Rough handling during the transport may also contribute to the leakage.
2. The LT terminals connected through the cables to LT take off lines. If these cables are not properly wired through the wooden cleats they cause some loading on LT Bush rods and finally results to burnt out.
3. Deposits of the coal dust, saline or chemicals on the bushing may cause a flash over, as the bushings will lose their insulating properties.
4. Sufficient place around a transformer to dissipate the heat must be provided. If the two transformers are kept close the surfaces may get clogged and oil temperature increases endangering to coil insulation.
5. Vapours at the top of the oil cooled transformers, may be explosive. Bringing naked lamps at the places may cause damage as we can see in figure 1.

2.3. Electric Circuit failure in Transformer

Following are the causes of Failure of Electric Circuit in Transformer:

1. Moisture entering the tank by breathing action of the transformer reduces the di-electric strength of oil. The results in the breakdown from the coils or terminal leads to tank or core structures. The greatest damages is however the inter turns short in the coils of the transformer.
2. Deterioration of the oil may occur due to the prolonged over loading of the transformer. This action is aggravated by the presence of the copper and lead. When the oil temperature increases formation of sludge, water and acids are accelerated.
3. Certain amount of the oil is lost due to evaporation and oxidation while the transformer is in service. Periodical topping up of the oil level with the fresh tested oil is necessary, leads to unit gets over heated.
4. Narrow oil ducts and improper ventilation reduces the useful life of a transformer. Oil insulation turns into brittle and may get punctured.
5. Sometimes the clearance, provided between phases is insufficient. Also the insertion of the press board barriers may aggravate as they may up set the di-electric stress to throw too much stress across the coil spaces and across the barriers.
6. Wooden ducts provided for taking the terminal leads over them that should be properly dried. These may cause the short circuit between tapping leads.
7. Presence of the foreign particles in oil reduces the di-electric strength of the insulating oil and may cause a flash over resulting in the serious breakdown of the transformer.
8. When the acidity value of the oil increases, it will promote the oxidation of the metal parts and results in a breakdown.

2.4. Magnetic Circuit failure in Transformer

Following are the causes of Failure of magnetic circuit in Transformer:

1. The laminations are clamped together by inserting the bolts through core and yoke. The bolts are provided with the insulation around them which may give way. This total amount to a short in lamination causing the local eddy currents. When this trouble occurs, in due two boltssimultaneously they form a short circuit turn through which the magnetic flux passes. If one of the bolts situated at the ends of the limb fail simultaneously they form a short circuit turn through which the magnetic flux passes. If one of the bolts situated at the ends of the limb that fails simultaneously with an adjacent bolt-in-the yokes. The patch between the two bolts is threaded by almost the entire value of the magnetic flux when passing from the core to yoke. The heat generated is so severe to cause a distortion of the whole core also causing a charring of the insulation and a resultant short circuit between the turns of adjacent windings.

2. Failure may occur of the insulation between the lamination and insulation between yoke clamping bolts fails. This registers the increment in the iron losses of the transformers.
3. Core clamping bolts should be securely tightened and locked lest vibration will set up causing the damage of core insulation and produce failures.
4. Care should be taken to ensure that the edges of the core and yoke lamination do not develop burns which may in turn produce local short circuit in the lamination.
5. No metallic fillings should be allowed to be present in between the lamination in finished transformers which causes short circuit.

2.5. Lighting Effect in Transformer

A lightning strike occurs when the voltage generated between a cloud and the ground exceeds the dielectric strength of the air. This results in a massive current stroke that usually exceeds to 30,000 amps. To make the matters worse, most strokes consist of the multiple discharges within a fraction of a second. Lightning is the major reliability concern for the utilities located in high keraunic areas. Lightning can affect the power distribution systems through the direct strikes (the stroke contacts the power system) or through indirect strikes (the stroke contacts something in close proximity and induces a travelling voltage wave on the power system).

FIGURE 2: LIGHTING EFFECT IN TRANSFORMER

3. DISCUSSION

After studying section 2, we found there are several failures that caused due internal or external factors. We found almost all the parts in a transformer liable to failure on opening a failed transformer it is often very difficult to say definitely the reason for the failure as all evidence is eliminated by the very nature of the break down. Consequently the cause of the failures is only a matter of guess.

Transformers are critical links in the power systems, and can take a long time to replace if they fail. Through faults cause extreme physical stress on the transformer windings, and are the major cause of the transformer failures. When a transformer becomes hot, the insulation on the windings gets slowly breakdown and hence becomes brittle over time. The rate of the thermal breakdown approximately doubles for every 10°C. Because of this exponential relationship, the transformer overloads can result in rapid transformer aging. When the thermal aging has caused insulation to become sufficiently brittle, the next fault current that passes through the transformer will mechanically shake the windings, a crack will form in the insulation, and an internal transformer fault will result.

Also, the transformer failure could be due to electric circuit failure that may have some barriers which could result in failure of the transformer circuit similarly magnetic circuit could be due to some internal problem such as insulation between lamination, insulation between yoke clamping bolts fails, no metallic fillings etc. that cause the failure of transformer simultaneously Power Distribution system. Similarly, the lighting can cause increment in the temperature of the Transformer which in turn causes failure of Transformer.

4. CONCLUSION AND SUGGESTIONS

Conclusion

In this paper, the main causes of incidences and failures in the power distribution systems have been explored. As the demand for the electrical power is increasing day by day, the distribution system plays an important role in catering the needs of consumers. For the reliability in maintaining the un-interrupted power supply one must have an efficient distribution system. The failure of a distribution transformer leads to the breakdown in power distribution system to all the consumers. Therefore the reliability in the power distribution system mainly depends on the reliable functioning of the distribution transformer. The failures in the Power Distribution System often comes due to several causes those are transformer problem, mechanical damages, electrical circuits, magnetic circuits, lighting etc. which in turn causes several incidents.

Suggestions

1. Careful design and construction on the part of the manufacturer, without subordinating quality to competition in the market is necessary, on the part of the purchasers also the economic behind the purchase should not be arrive at by cost alone but by performance guarantee.
2. Timely preventive maintenance is the back bone for the safe and efficient operation of any electrical equipment such as transformer the maintenance scheduled as well as the construction standards drown up by the APCPDCL are exhaustive enough to detect and prevent a possible failure ahead. If these are adhering it may be possible to reduce the failures to the large extents.

5. ACKNOWLEDGEMENT

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Characterization Techniques for Liquid Crystal Materials and its Application in Optoelectronics Devices

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ABSTRACT

This research employs characterization techniques for liquid crystal materials and its application in optoelectronics devices. Two-dimensional (2D) nano composite materials with dynamically tunable liquid crystalline properties have as of late developed as a highly-encouraging class of novel, useful materials, opening new courses inside a wide assortment of potential applications from the deposition of highly uniform layers and heterostructures, to novel display technologies. Here, we will present the fundamental ideas that support this ongoing mechanical progress; give an outline of the engineered courses towards such 2D nano composite materials; and survey late advances in the application and appropriateness of these materials inside the fields of optoelectronics and photonics. Since the approach of graphene in 2004, there has been a blast in the examination of an extensive variety of molecularly thin (two-dimensional) materials.

1. OVERVIEW

The liquid crystal phase is a phase of issue that exists for an assortment of particles and materials, contingent upon their geometric and substance properties, with qualities middle to those of an ordinary crystalline strong and a liquid[1]. Liquid crystals (LCs) have discovered use in an assortment of applications as the years progressed. The liquid crystal phase was at first portrayed by Austrian botanist Friedrich Reinitzer in 1888 when taking a gander at the properties of cholesterol subsidiaries, albeit some credit likewise goes to Julius Planer, who announced comparable perceptions 27 years prior[2].

This new and unmistakable condition of issue was then recognized as the "liquid crystal phase" by Otto Lehmann in 1890 and in 1904 the principal monetarily accessible LCs were created by Merck-AG. Over the accompanying 18 years, researchers built up the presence of three particular liquid crystalline phases (nematic, smectic and cholesteric) at the same time, without any applications of note inevitable, the investigation of LCs was stopped. For the following 30 years, established researchers disregarded LC materials, considering them as an intriguing curiosity[3]. Be that as it may, following a renaissance in liquid crystal science in the 1950s, the beforehand logical interest has turned into a pervasive piece of the advanced technology scene.

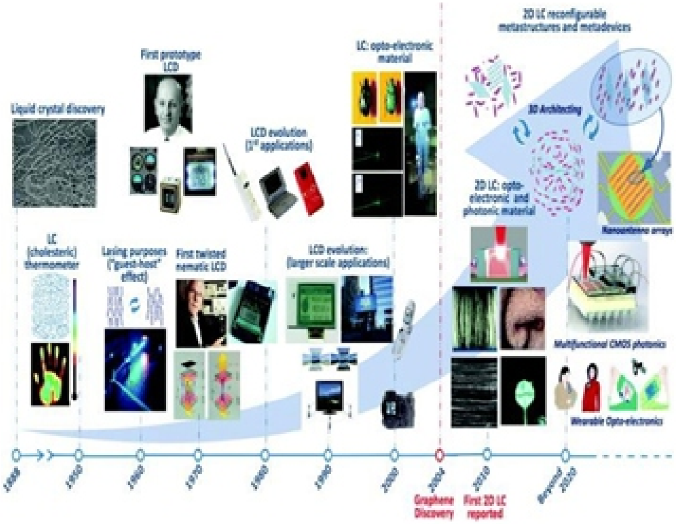

Figure 1: Timeline of the History of Liquid Crystal Phase Applications, From Their Discovery to the Present Day

During the 1950s, the innovation of the primary cholesteric LC temperature pointers, and additionally advances in scientific metrology, tumor diagnostics, and non-ruinous material testing techniques drove another period in liquid crystal science. By 1962, liquid crystals were at that point discovering applications in best in class laser devices, in spite of the relative youth of laser science. Be that as it may, the most critical mechanical advancement came in 1965 with the improvement of the primary LC displays (LCDs). Like this, wound nematic LCDs (1969– 1971) propelled the field further[4].

Huge leaps forward in the advancement of liquid crystal technologies happened in the 1980– 1990s and kept on having a significant effect on everyday life: the scaling down of display technologies encouraged the improvement of compact PCs, cell phones and innumerable other innovations[5]. Since, the beginning of the new thousand years, LCs and as of late found 2D material LCs have come into the request as optoelectronic and photonic materials. The likelihood of the presence of a liquid crystal phase stems basically from the geometric structure of the particles in the material, and also the practical groups exhibit in the atom.

In lyotropic liquid crystals, mesogens are scattered in a host dissolvable (regular water however other natural solvents can be utilized relying upon the atom). Lyotropic liquid crystals show a liquid crystal phase inside a specific scope of temperatures yet also require a centralization of the dynamic mesogens that falls inside a specific range. In the lyotropic phase, the ease of the material is prompted by the dissolvable particles as opposed to being characteristic for the mesogens themselves. The mesogens contain immiscible solvophilic and solvophobic parts isolated at contradicting 'finishes' or aspects of the particle, making them amphiphilic.

2. LIQUID CRYSTALS

Liquid crystals (LC) are partially ordered anisotropic fluid that exists between crystalline solid and isotropic liquid as shown in Figure 2 (Larson & Ronald 1999). If the temperature increases the molecules flow like a liquid but also have some degree of ordering in its molecular arrangement.

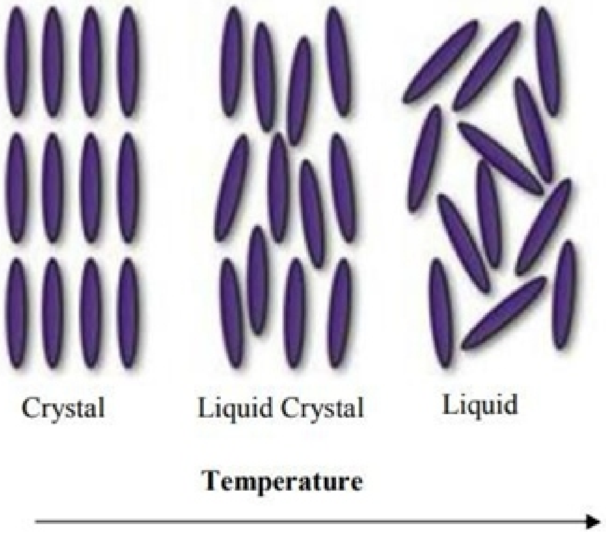

Figure 2 Schematic illustrations of the crystalline solid, liquid crystal and isotropic liquid

LC materials are bounteous in nature as proteins, cell films and viruses. They are utilized as a part of the assembling of numerous electronic devices to be specific level LC display (LCD), plasma TV screens, guides, cell phones, individual advanced aides, organic lighting, solar cells devices, and so on. Because of this, there is an expanding interest for LC materials for different applications. The simple process capacity and great reasonableness make these organic materials extremely appealing towards numerous application perspectives. In addition to that the hydrogen bonded liquid crystals (HBLC) have earned research enthusiasm towards the different application aspectsin the most recent two decades.

3. TYPES OF THERMOTROPIC LIQUID CRYSTALS

Based on the positional and orientation orders of molecules, it is classified into two types

1. Orthogonal phase
2. Tilted phase.

These phases are further again sub-divided into many types. Mainly it is classified into

1. Nematic (N) phase
2. Cholesteric phase and
3. Smectic (Sm) phase.
4. This type of separation.

Further, thermotropic LC are classified according to their molecular shape and is alienated into

1. Calamitic LC
2. Discotic LC (DLC)
3. Polymeric LC
4. Banana shape of rod like, disc like and bend core molecules.

Nematic phase

N phase is the most vital phase in the LC. The name N landed from Greek word nema which implies string like structure. This term impels from string like topological structure which is seen in the Ns, and is formally called as disclinations. Ns are additionally called hedgehog topological imperfections.

Cholesteric Phase

Cholesteric phase has smoothness like the N phase given long-range translational request. For a neighborhood scale, cholesteric phase and N phase are fundamentally the same. By the by on a bigger scale, the cholesteric chief n follows helix structure because cholesteric mesogens are shaped by the optically dynamic material.

4. SYNTHESIS AND CHARACTERIZATION TECHNIQUES

These days blend of high-quality materials with wanted properties is most extreme imperative in the consolidated test issue physical science research. A few physical, chemical and natural combination methods have been produced to upgrade the performance of nanomaterials displaying enhanced properties with the intent to have a little control over the particle measure appropriation and morphology. The required nanostructure can be blended in an assortment of shapes and sizes relying on their necessities, for example, single crystals, composite, undefined solids, thin films, thick films, polycrystalline powder, and so forth.

5. CHARACTERIZATION AND TEXTURE OBSERVATIONS OF CALAMITIC LIQUID CRYSTALLINE COMPOUNDS

Liquid crystalline conduct has been watched for the most part in two kinds of molecules: linear or bar like molecules that frame calamitic phases and circle like molecules that shape discotic phases. The structure of liquid crystalline phases is described by the game plan of the molecules, the compliance of the molecules, and the intermolecular collaborations. The transition between the different liquid crystal mesophases from crystalline to smectic to nematic happens at characterized temperatures which can be distinguished utilizing differential filtering calorimetry, while the nature and surface of the mesophase is typically investigated utilizing enraptured optical microscopy.

6. OPTOELECTRONICS

Liquid crystalline nanocomposites fusing 2D material particles demonstrate awesome guarantee for optoelectronic applications because of their field prompted tunability and upgraded usefulness originating from the plenty of properties displayed by the scope of exfoliative materials. For instance, scatterings of liquid crystalline graphene oxide have been appeared to experience electro-optical exchanging with low edge voltage necessities. By balancing out a suspension of diminished GO utilizing surfactants, they showed expanded time security and enhanced electro-optic properties with an initiated birefringence twice as vast at a similar field quality as that with an unreduced GO suspension.

6.1. Optoelectronic Property

The most important factor responsible for a material to show a better optoelectronic property is the large exciton binding energy and this property is posseessed by Zinc oxide having binding energy of 60mev which could be attended at and above room temperature due to excitonic recombination. The process of optical absorption and emission have been influenced by bound excitons which are extrinsic transition related to dopants or defects thereby usually responsible for creating discrete electronic states in the band gap. Theorytically, neutral or charged donors and acceptors are the members by which exciton could be bound with and it merely depends on the band structure of semiconductor material.

6.2. Application and Prospectus

The self-assembling nature of liquid crystalline materials has prompted the utilization of graphene oxide scatterings for the arrangement of all around requested layers and piles of 2D materials. That graphite suddenly sheds into single-layer graphene in chlorosulfonic corrosive, and immediately frames liquid-crystalline phases at high concentrations. Straightforward, directing movies were delivered from the liquid crystalline scatterings. The readied scatterings were utilized to accomplish self- amassed layer-by-layer multifunctional 3D crossover structures involving SWNTs and GO with promising mechanical properties.

6.3. Types of Optoelectronics Devices with Applications

Optoelectronics is the communication between optics and electronics which includes the study, design and manufacture of a hardware device that converts electrical energy into light and light into energy through semiconductors. This device is made from solid crystalline materials which are lighter than metals and heavier than insulators. Optoelectronics device is basically an electronic device involving light. This device can be found in many optoelectronics applications like military services, telecommunications, automatic access control systems and medical equipment's.

This academic field covers a wide range of devices including LEDs and elements, image pick up devices, information displays, optical communication systems, optical storages and remote sensing systems, etc. Examples of optoelectronic devices include telecommunication laser, blue laser, optical fiber, LED traffic lights, photo diodes and solar cells. Majority of the optoelectronic devices (direct conversion between electrons and photons) are LEDs, laser diodes, photo diodes and solar cells. Optoelectronics are classified into different types such as:

- Photodiode
- Solar Cells
- Light Emitting Diodes
- Optical Fiber
- Laser Diodes

Photo Diode

A photo diode is a semiconductor light sensor that creates a voltage or current when light falls on the intersection. It comprises of a functioning P-N intersection, which is worked backward inclination. At the point when a photon with a lot of vitality strikes the semiconductor, an electron or entire combine is made. The electrons diffuse to the intersection to frame an electric field. This electric field over the exhaustion zone is equivalent to a negative voltage over the unprejudiced diode. This strategy is otherwise called the internal photoelectric effect. This device can be utilized as a part of three modes: photovoltaic as a sun powered cell, forward one-sided as a LED and turn around one-sided as a photo identifier.

Solar Cells

A solar cell or photo-voltaic cell is an electronic device that specifically changes over sun's energy into electricity. At the point when sunlight falls on a solar cell, it produces both a current and a voltage to deliver electric power. Sunlight, which is made out of photons, transmits from the sun.

Light-Emitting Diodes

Light-emitting diode is a P-N semiconductor diode in which the recombination of electrons and openings yields a photon. At the point when the diode is electrically one- sided the forward way, it emanates incongruous tight spectrum light. At the point when a voltage is connected to the leads of the LED, the electrons recombine with the gaps inside the device and discharge energy as photons. This effect is called as electroluminescence.

Optical Fiber

An optical fiber or optic fiber is a plastic and straightforward fiber made of plastic or glass. It is to some degree thicker than a human hair. It can work as a light pipe or waveguide to transmit light between the two finishes of the fiber. Optical filaments as a rule incorporate three concentric layers: a center, a cladding and a coat. The center, a light transmitting district of the fiber, is the focal segment of the fiber, which is made of silica. Cladding, the defensive layer around the center, is made of silica.

7. ELECTRONIC AND OPTOELECTRONIC APPLICATIONS

Inorganic materials are favored for NLO applications over organic materials. The single crystals of unadulterated inorganic materials, for example, quartz, lithium niobate (LINbO3), potassium dihydrogen phosphate (KDP), potassium titanyl phosphate (KTP), and urea, show excellent NLO properties. These are the unadulterated inorganic materials utilized as a part of second harmonic generating devices, parametric oscillators, and so forth. A portion of the recognizable properties of inorganic host materials are huge mechanical quality, excellent thermal soundness, great transmittance, and high electro-optic coefficients and additionally high level of chemical inactivity.

The most recognizable single crystals of KDP display prevalent NLO properties and have been utilized as reference materials for correlation with other crystalline materials. The transmittance, hardness, and dielectric constants are enhanced by developing KDP crystals utilizing the Sankaranarayanan-Ramasamy method contrasted and the ordinary slow evaporation method. NLO materials, for example, lithium sulfate, potassium lithium niobate, and lithium triborate have exceptional focal points, for example, an expansive damage edge, high phase coordinating edge, more extensive straightforwardness range, and chemical security. Additionally, lithium sulfate monohydrate has been named a promising material for Raman laser recurrence converters. We have been growing a few inorganic materials that show high straightforwardness, great chemical steadiness, and elasticity and also second harmonic generation (SHG), recurrence transformation, optical parametric amplification (OPA), optical parametric wavering (OPO), optical emanation and electro-optical applications.

8. CONCLUSION

We displayed difficulties of existing 2D material process innovations, to be specific contaminations, reproducibility, and versatility. An assortment of 2D photonic devices that demonstrate additional functionalities contrasted with best in class mass devices was exhibited. A portion of the characteristic properties of graphene, for example, the nonappearance of an electronic band hole, transporter multiplication, and high bearer portability, propose applications as broadband and high-speed photodetectors, which have been demonstrated in a few occurrences. Even though the monoatomic idea of graphene presents a limitation in the absorbance, numerous promising solutions are being sought after.

New impetuses and critical advance in investigations of ring opening polymerization (ROP) and ring opening metathesis polymerization (ROMP) take into account much better characterized polymeric structures. Vital info can be relied upon from research gave to non-covalent side chain systems. Numerous endeavors have been embraced to acquire SCLCP's layered nanomaterials by ion and hydrogen bonding driven self-get together. It offers less demanding and more effective engineered way to deal with the entire range of new polymers. A few new main chain/side chain structures have been synthesized tossing all the more new light on the effect on the structure-properties relationships.

Since the electronic conduction in liquid crystals was found in the 1990's, ten years have passed. With continuous interests in investigating its new edge, a great reason for the second step towards device applications has been well settled, incorporating general highlights in control bearer transport properties and their hypothetical understandings in liquid crystals, which furnish us with the degree and limitation of their properties, and variation of materials having high versatility. Along these lines, we can give a correct position to the liquid crystalline materials in natural materials. Presently, we require another push to open the entryway looking another horizon of natural optoelectronic devices through, with a well-ordered way to deal with have the responses to the issues portrayed later on works, in which we need to co-work with materials researchers, physicists, scientists, and electrical designers as it happened to liquid crystal displays.

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