International Journal of Electrical and Electronics Engineers
Volume 16, Issue No. 01, Jan-June 2024
ISSN (O) 2321-2055
ISSN (P) 2321 -2045

# Magnato Optic Current Transfrormer

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**ABSTRACT:-**

In the majority of magneto-optical current transformers developed to date, the main parameter is the angle of light polarization (Faraday rotation). In contrast, the principle of operation of the new sensor is based on the direct registration of the domain wall (DW) positions in an orthoferrite plate. The results of the measurements are not affected directly (but the signal-to-noise ratio) by temperature changes of Faraday rotation, birefringence, fluctuations of the incident light beam, polarization distortions in fibers, etc. The amplitude of domain wall motion remains constant in the range from dc to hundreds of kHz and decreases two times at 5 MHz. In the temperature range from 20 to 130°C, the domain wall mobility and the bandwidth decrease about three times.A current measurement technique using the magneto-optic or Faraday effect, has been developed, tested, and demonstrated. The device developed is a magneto-optic current transducer (MOCT). It uses the rotation of the plane of polarization by a magnetic field exhibited in certain glasses (Faraday effect). Test data obtained in an extensive field evaluation of the MOCT were compared with the design qualification data gathered during the development phase of this project. The analysis indicates that operation of the MOCT-based metering system under field conditions compares favorably with performance predicted during design qualification.

***Keywords:-***

Magnatostrictive Materials' ; Magnato optical effect ; optical fiber current sensor ; Artifical micro-nano structures.

**INFROMATION:-**

Magneto Optic Current Transformer Market provides an overview of the market along with current market dynamics, trends, and developments. Also included are market CAGRs, revenue values, volumes, and forecasts. This study also categorizes the market based on volume, revenue, and price history, as well as identifying opportunities and gaps. The report also provides regional breakdowns covering North America, South America, Asia Pacific, the Middle East, and Africa.Magneto Optic Current Transformer Market is estimated to grow at a CAGR of 9% & reach US$ 260 Mn by the end of 2030.A magneto-optic current transformer (MOCT) is a type of current transformer that uses the magneto-optic effect to measure electrical current. It consists of a coil of wire wrapped around a ferromagnetic core and a magneto-optic material, such as a garnet crystal, placed within the coil. When an electrical current flows through the coil, it generates a magnetic field within the core. This magnetic field causes the magneto-optic material to rotate the polarization of light passing through it, and this rotation can be measured to determine the magnitude of the electrical current. MOCTs have several advantages over traditional

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current transformers, including the ability to measure high-frequency currents, the ability to measure currents in multiple phases simultaneously, and the ability to operate without requiring electrical contact with the conductor being measured.

Magneto-optical (MO) effects, viz. magnetically induced changes in light intensity or polarization upon reflection from or transmission through a magnetic sample, were discovered over a century and a half ago. Initially they played a crucially relevant role in unveiling the fundamentals of electromagnetism and quantum mechanics. A more broad-based relevance and wide-spread use of MO methods, however, remained quite limited until the 1960s due to a lack of suitable, reliable and easy-to-operate light sources. The advent of Laser technology and the availability of other novel light sources led to an enormous expansion of MO measurement techniques and applications that continues to this day (see section 1). The here-assembled roadmap article is intended to provide a meaningful survey over many of the most relevant recent developments, advances, and emerging research directions in a rather condensed form, so that readers can easily access a significant overview about this very dynamic research.The principle of magneto-optical sensorsThe plane of polarization of linearly polarized light was rotated under the influence of a magnetic field parallel to the direction of light proportion when light is propogated in a piece of glass and the rotation angle was proportional to the intensity of the magnetic field .When the magneto-sensitive material is placed in a external magnetic field, the magneto-sensitive material will change accordingly with the magnetic field, including size, optical refractive index, optical polarization response, and other properties. This section will introduce magnetostrictive materials and magneto-optical materials.

**FARADAY LAW:-**

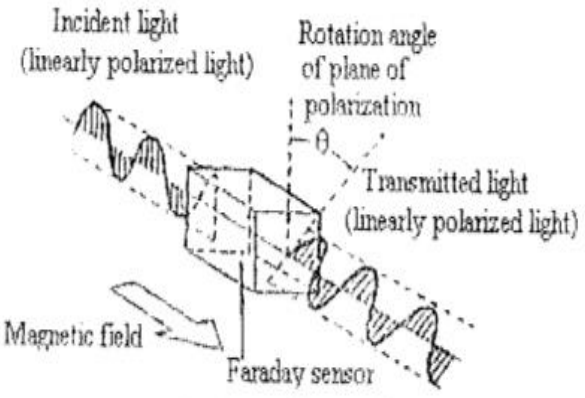


Fig.1: Concept of Faraday Effect

**WORKING:-**

The light rays are polarized by passing beam them through a polariser material.these polarized light rays are then passed through an optical rotator. The phase orientation of the light beam is rotated as it travels through the rotator material amount of rotation is directly proportional to the current passing through the conductor.the analayzer second polarizer measures the amount of shift in the light beam into corresponding amount of light intensity.this intensity modulated light is conducted through an optical fibre to a PIN doide which generates the corresponding electric signal which is then amplified and filtered.Magnetostrictive effectThe magnetostrictive effect, which refers to the change of the length of a ferromagnetic material as a function of the magnetic field

strength (B), was first discovered by Joule To explain the magnetostrictive effect, we will first cut to the microscopic point of view. The spin of the electron on the microscopic scale creates a magnetic field, and at the same time, the electron spins around the nucleus, creating another magnetic field. The interaction of the two magnetic fields causes unpaired electrons with different spins to align in the same direction [18]. The attraction between atoms causes adjacent atoms in the two crystals to attract each other, but the distance between the atoms is hindered by the electrons outside the nucleus. The reason is that the orbits of the electrons cannot cross, so the outer electrons have a high probability of unpaired electrons, these unpaired electrons contribute to the magnetic properties of the material Normally, the inner electron orbitals are circular. But in common magnetic elements, such as transition metal elements and heavy metal elements, the high asymmetry of the outer electron orbital leads to an ellipse that elongates in one direction and contracts in the other direction. Also in crystal lattices the distance between an individual atom or ion and its nearest neighbor depends on where that neighbor is. Therefore, in some specific crystal orientations, the material is more easily magnetized. As a result, atoms or ions in a part of the crystal tend to spontaneously form magnetic domains, including the spin directions and orbits of unpaired electrons in the same direction.

## ADVANTAGES:-

- High accuracy, low weight, easy installation and no-saturation.
- No risk fires and explosion.
- No need to be use metalic wires to transfer the signal and so simple insulator structure the conversational current transformer.
- Hight immunity to electromagnetic interference.
- No ratio change required.
- No saturation under fault current.
- Low voltage output which are compatible with the inputes of digital to analog converter.

## FUTURE SCOPE:-

Magneto Optic Current Transformer market report covers extensive and comprehensive data on market introduction, segmentations, status and trends, opportunities and challenges, industry chain, competitive analysis, company profiles, and trade statistics. It offers a comprehensive analysis of each segment, including types, applications, key players, major regions, sub-divisions of countries, and, in some cases, end-users, channels, and technologies. The Magneto Optic Current Transformer market has experienced substantial growth in recent times, propelled by several pivotal factors, including a rising desire for its offerings, the broadening of its customer demographic, and strides in technological innovations

## CONCLUSION:-

This magneto optical current transformer eliminates many of the drawbacks of the conventional current transformers. In an conventional current transformers, there is a chance of saturation of magnetic field under high current, complicated insulation and cooling structure, a chance of electromagnetic interference.

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