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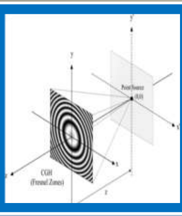

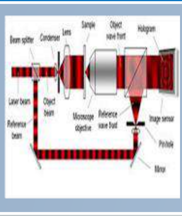

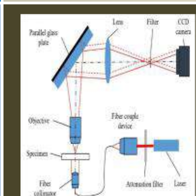

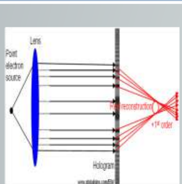

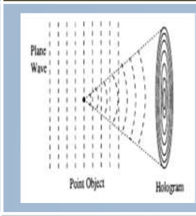

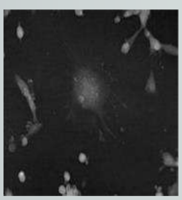

ISO 17901-2:2015 Methods for measurement of hologram recording Characteristics

What is ISO 17901-2:2015 Methods for measurement of hologram recording characteristics?

Holographic interferometry (HI) is a technique which enables static and dynamic displacements of objects with optically rough surfaces to be measured to optical interferometric precision (i.e. to fractions of a wavelength of light). These measurements can be applied to stress, strain and vibration analysis, as well as to non-destructive testing and radiation dosimetry. It can also be used to detect optical path length variations in transparent media, which enables, for example, fluid flow to be visualised and analyzed. It can also be used to generate contours representing the form of the surface.

Holography is the two-step process of recording a diffracted light field scattered from an object, and performing image rendering. This process can be achieved with traditional photographic plates or with a digital sensor array, in digital holography. If the recorded field is superimposed on the 'live field' scattered from the object, the two fields will be identical. If, however, a small deformation is applied to the object, the relative phases of the two light fields will alter, and it is possible to observe interference. This technique is known as live holographic interferometry.

It is also possible to obtain fringes by making two recordings of the light field scattered from the object on the same recording medium. The reconstructed light fields may then interfere to give fringes which map out the displacement of the surface. This is known as 'frozen fringe' holography.

The form of the fringe pattern is related to the changes in surface position or air compaction.

Discovery

Several research groups published papers in 1965 describing holographic interferometry. While the first observations of phenomena that could be ascribed to holographic interferometry were made by Juris Upatnieks in 1963 the essential feature of the process was not understood until the work of Powell and Stetson. Their experiments were conducted over the period of October to December 1964, and they began with an investigation of the periodic coherence length of the HeNe laser being used. The compact laser beam was used to illuminate a spot on a small object was placed between two mirrors such that its image could be observed looking over one mirror into the tunnel of multiple reflections between the mirrors. Each image was 10 cm greater in path length than the one before it. Because these lasers had about three longitudinal modes, their coherence length was periodic, as described by the manufacturer, Spectra Physics in cooperation with the Perkin Elmer Corporation. This was demonstrated by recording a hologram of the view over one of the mirrors.

In one of the holograms, however, a dark band was observed in the closest image to the hologram, and it was observed to shift position with perspective. This band was not observable in the original laser beam and had to be something created by the holographic process. The confocal laser cavity consisted of a spherical mirror at the output end with a flat mirror at the center of curvature at the other end. Adjustment of the longitudinal spacing controlled the number of off-axis modes of oscillation, and it was observed that the laser was oscillating in more than one axis mode. The multiple laser modes were incoherent and did not interfere in the observable laser beam, so why did they interfere in the hologram reconstruction? Stetson put forth the idea that each mode existed in both the object and in the reference beam, and each pair recorded a separate hologram in the photographic plate. When these were reconstructed, both recordings reconstructed simultaneously from the same laser beam and the fields were then mutually coherent. Powell objected to this idea, because it implied that the hologram had the power to coherently reconstruct fields that were incoherent during its recording.

The resulting arguments gave rise to a set of experiments that were later published in 1966. These consisted of: (1) Recording the reflection of a concentrated laser beam while capturing the entire reference beam on the hologram and adjusting the laser for combinations of off-axis modes. (2) Recording double-exposure holograms of an object where the object, the reference beam mirror, and the hologram itself were rotated slightly between exposures. (3) Recording holograms of the bottom of a 35 mm film can while it was vibrating. Later, in April 1965, Stetson and Powell obtained real-time interference patterns between a real object and its holographic reconstruction.

Applications

Laser vibrometry

Since its introduction, vibrometry by holographic interferometry has become commonplace. Powell and Stetson have shown that the fringes of the time-averaged hologram of a vibrating object correspond to the zeros of the Bessel function ,where is the modulation depth of the phase modulation of the optical field at on the object. With this method, the local vibration amplitude can be assessed by fringe counting. In the work reported by Aleksoff, the reference beam was shifted in frequency to select one sideband of order.In that case, the fringes for sideband correspond to the zeros of the Bessel function . By sequential imaging of frequency sidebands, the issue of fringe counting has been alleviated. The side band order is a marker of the local amplitude of sinusoidal out-of-plane motion. Multiplexed measurements of optical sidebands enable quantitative measurements of out-of-plane vibration amplitudes much smaller than the optical wavelength.

Laser Doppler imaging

In off-axis configuration, with a slow camera and a laser diode, holographic interferometry is sensitive enough to enable wide-field, laser Doppler imaging of optical fluctuations in amplitude and phase, either with a slow or a fast camera. A slow (e.g. video rate) camera will record time-averaged holographic interferograms which will result in lowpass filtering of the optical fluctuation signal. By shifting the frequency of the reference beam, the lowpass filter becomes a bandpass filter centered at the detuning frequency, and selective narrowband detection and imaging can be performed. This method permits microvascular blood flow imaging, and wide-field measurement of photoplethysmograms by detection of out-of-plane tissue motion. The wide temporal bandwidth of a high throughput camera can enable wideband detection and analysis of optical fluctuations. It can be used for pulsatile blood flow imaging.

List of International Organization for Standardization standards

This is a list of published International Organization for Standardization (ISO) standards and other deliverables. For a complete and up-to-date list of all the ISO standards, see the ISO catalogue.

The standards are protected by copyright and most of them must be purchased. However, about 300 of the standards produced by ISO and IEC's Joint Technical Committee 1 (JTC 1) have been made freely and publicly available.

ISO Brand

This is a dynamic list and may never be able to satisfy particular standards for completeness. You can help by adding missing items with reliable sources.

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Background

Organizations of all types and sizes increasingly want to reduce the amount of energy they consume. This is driven by the need or desire to:

- reduce costs,
- reduce the impact of rising costs,
- meet legislative or self-imposed carbon targets,
- reduce reliance on fossil fuels, and
- enhance the entity's reputation as a socially responsible organization.

In tandem, governments increasingly want to reduce the Greenhouse Gas Emissions of their citizens and industries, and are imposing legislative mechanisms to compel carbon reduction more and more frequently.

In response, a range of energy management standards, specifications and regulations were developed in Australia, China, Denmark, France, Germany, Ireland, Japan, Republic of Korea, Netherlands, Singapore, Sweden, Taiwan, Thailand, New Zealand and the USA.

Subsequently, the European Committee for Standardization (CEN) developed EN 16001:2009 *Energy management systems. Requirements with guidance for use* as a first international energy management standard. This was published in July 2009 and withdrawn in April 2012 as it had been superseded by ISO 50001.

Development

The United Nations Industrial Development Organization (UNIDO) recognized that industry around the world needed to mount an effective response to climate change.[1] It also noted a proliferation of national energy management standards that were emerging as a response to market demand for help with energy efficiency.

In April 2007, a UNIDO stakeholders meeting decided to ask ISO to develop an international energy management standard.

ISO for its part had identified energy management as one of its top five areas for the development of International Standards and, in 2008, created a project committee, ISO/PC 242, *Energy management*, to carry out the work.

ISO/PC 242 was led by ISO members for the United States (ANSI) and Brazil (ABNT). In addition, its leadership included the ISO members for China (SAC) and the United Kingdom (BSI Group) to ensure that developed and developing economies participated together in the project committee.

Experts from the national standards bodies of 44 ISO member countries participated and another 14 countries sent observers. Development organizations including UNIDO and the World Energy Council (WEC) were also involved.

ISO 50001 also drew on existing national and regional energy management codes and standards, including ones developed in China, Denmark, Ireland, Japan, Republic of Korea, Netherlands, Sweden, Thailand, the US and the European Union.

ISO published a revised version of ISO 50001 in 2018. The revision reflects a desire to promote adoption of the standard among small and medium sized enterprises. It also incorporates ISO's "high level structure" for use where organizations wish to integrate a number of management system standards together.

Structure

The structure of ISO 50001 is designed according to other ISO management system standards, in particular ISO 9001 (Quality Management Systems) and ISO 14001 (Environmental Management Systems). Since all three management systems standards are based on the PDCA cycle, and now share the same high-level structure, ISO 50001 can be integrated easily to these systems.

There are ten major components to ISO 50001:2018:

- *1.*: Scope
- *2.*: Normative references
- *3.*: Terms and definitions

- *4.*: Context of the organization
- *5.*: Leadership
- *6.*: Planning
- *7.*: Support
- *8.*: Operation
- *9.*: Performance Evaluation
- *10.*: Improvement

Method

ISO 50001 provides a framework of requirements that help organizations to:

- develop a policy for more efficient use of energy
- fix targets and objectives to meet the policy
- use data to better understand and make decisions concerning energy use and consumption
- measure the results
- review the effectiveness of the policy and
- continually improve energy management.

ISO 50001 focuses on a continual improvement process to achieve the objectives related to the environmental performance of an organization (enterprise, service provider, administration, etc.). The process follows a plan – do – check – act approach.

The 4 phases of the PDCA circle

The overall responsibility for the installed energy management system must be located with the top management. An energy officer and an energy team should be appointed. Furthermore, the organization has to formulate the energy policy in form of a written statement which contains the intent and direction of energy policy. Energy policy must be communicated within the organization. The energy team is the connection between management and employees. In this phase the organization has to identify the significant energy uses and prioritize the opportunities for energy performance improvement.

Certification

Certification proves that the energy management system meets the requirements of ISO 50001. This gives customers, stakeholders, employees and management more confidence that the organization is saving energy. It also helps to ensure that the energy management system is working throughout the organization.

Another advantage of a certification is its emphasis on continual improvement. The organization will continue to get better at managing its energy. Additional cost savings can be generated over several years. Furthermore, certifying an organization shows your public commitment to energy management.

UKAS, the certification bodies' accreditation scheme in UK, accredits certification bodies to carry out certification of business energy management systems to ISO 50001. In July 2018, there were 15 UK bodies with the necessary accreditation to carry out independent audits and issue Energy Management Systems Certification to ISO 50001.

Impact

ISO reported that the standard was warmly received by the market when it was first published. To the end of January 2012, around 100 organizations in 26 countries had already achieved certification to ISO 50001. ISO also listed several users who had reported significant early cost savings and benefits.

In China, Delta Electronics, a provider of power and thermal management solutions, reported reducing power consumption by 10.51 million kWh as compared to the same period in 2010. This is equivalent to a reduction of 10.2 thousand tons of carbon emissions and a saving of CNY 8 million ($1.2m).

In India, the Dahanu Thermal Power Station in Maharashtra expected to accrue annual savings of about INR 96.4 million ($1.7m) from raised energy efficiency and management.

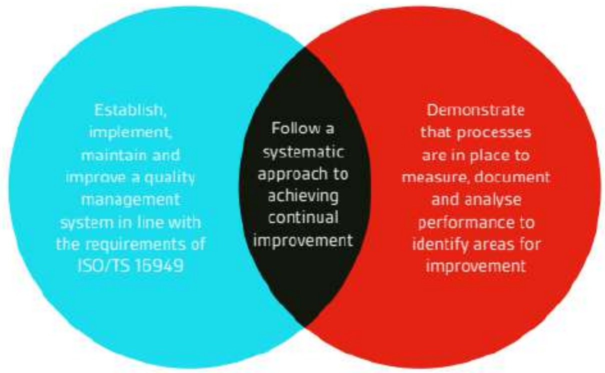
In Austria, the municipality of Bad Eisenkappel, with 2,400 inhabitants, expected its consumption of energy to be reduced by nearly 25 per cent, with the main savings achieved by updating the waste water plant and reducing energy consumption by 86 000 kWh, equivalent to €16,000 ($20.7k).

BSI Group published a case study showing that Sheffield Hallam University in the UK reduced its carbon emissions by 11 per cent once it was certified to ISO 50001. This yielded annual savings of over £100,000 ($160.7k).

In December 2013, the UK Department of Energy and Climate Change became the first Central Government department to achieve certification against the requirements of ISO 50001, leading by example with the belief that structured energy management will lead to substantial energy reductions and thus mitigate the effects of climate change.

ISO has stated that it believes in due course the standard could influence up to 60 per cent of the world's energy use.

The principal requirements of the standard are illustrated below:



The next few pages of the guide takes you through the Plan-Do-Check-Act (PDCA) methodology, common in all ISO management systems and how DCS can help and support you on your ISO/TS 16949 journey.

Understanding the principles of continual improvement