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Assignment 2

Ever since the advent of the first LASER (Light Amplification by Stimulation Emission) in 1960 there has been steady increase in the application of lasers. Applications have kept on becoming more and more diverse as the capability of the lasers have increased.

Lasers:

Lasers delivers coherent, monochromatic, well-collimated and precisely direct light beams. A priori, therefore lasers would seem to be poor choice for general purpose illumination, however, they are ideal for concentrating light in space, time or particular wavelength. Lasers have been regularly used to measure, cut, drill, weld, read, write, send messages and perform delicate eye operations.

Characteristics:

Laser light has four unique characteristics that diff. it from ordinary light. These are,

- Coherence
- Directionality
- Monochromatic
- High Intensity

Application Categories:

Optical Communication

The ability to focus laser beams onto very small spots to switch them off and on billions of times per second makes lasers very important tool in telecommunication and information processing. In laser supermarket scanner, a rotating mirror scans a red beam while clerks move packages across the beam.

Fibre-optic communication systems that transmit signal more than a few kilometers also use semiconductor laser beams. The optical signals are sent at infrared wavelengths of 1.3 to 1.6 micrometers, where silica glass fibre are most transparent. This technology has become the backbone of the global telecommunication network and most telephone calls travelling beyond the confines of a single town go part of the way through optical fibres.

Industry and Manufacturing:

Lasers are widely used in manufacturing eg for cutting, drilling welding, cladding surface treatment, pulsed laser deposition, lithography etc.

In many cases, relatively high optical intensities are applied to a small spot, leading to intense heating, possibly evaporization and plasma generation

Laser-aided manufacturing often allows one to produce the essentially same parts with higher quality and/or lower cost. Also, it is often possible to realize entirely new parts design or the use of new material. Lasers are also widely used for alignment purposes. Alignment lasers may emit a Gaussian laser beam, forming a circular spot on a workpiece, a line, a cross, or some other pattern.

Medical applications:

There is a wide range of medical applications. Often these relate to the outer parts of the human body which are easily reached with light; examples are eye surgery and vision correction (LASIK), dermatology and various kinds of cancer treatments.

Lasers are used for surgery, exploiting the possibility to cut tissues well causing minimal bleeding. Some operations can be done with endoscopic means, an endoscope may contain an optical fibre for delivering light to the operation scene and another fibre for imaging, apart from additional channels for mechanical instruments.

Various Scientific Applications:

Laser cooling makes it possible to bring clouds of atoms or ions to extremely low temperature. This has applications in fundamental research and also for industrial purposes.

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Particularly in biological and medical research, optical tweezer can be used for trapping and manipulating small particles such as bacteria or parts of living cells.

Laser Imaging and Holography.

The coherence of laser light is crucial for ~~in~~ interferometry and holography, which depends on interaction like light waves to make extremely precise measurements and to record three dimensional images. The result of adding light waves together depends on their relative phases. If the peak of one align with the valleys of other, they will interfere destructively to cancel each other out; if their peaks align, they will interfere constructively to produce a bright spot.

This effect can be used for measurement by splitting a beam into two identical halves that follow different paths.

This technique has proved invaluable for precise measurements of very small distances.

Holograms are made by splitting a laser beam into two identical halves, using one beam to illuminate an object. This beam then recombines with other half in plane of photographic plate producing a recorded looking pattern of light and dark zones. Later, when laser light illuminates that pattern from same angle as reference beam is scattered to construct original 3-d image of object.