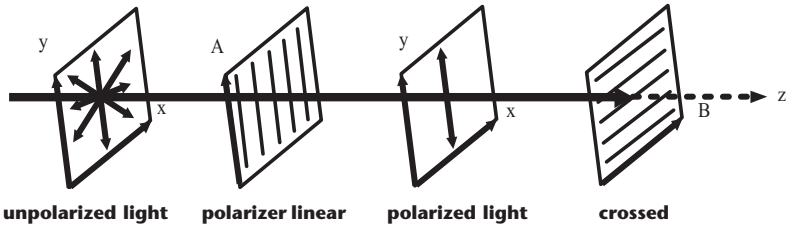
Working with Polarized Light

Some lighting applications show unwanted light reflections or glare. Using polarizing kits helps to eliminate these reflections.

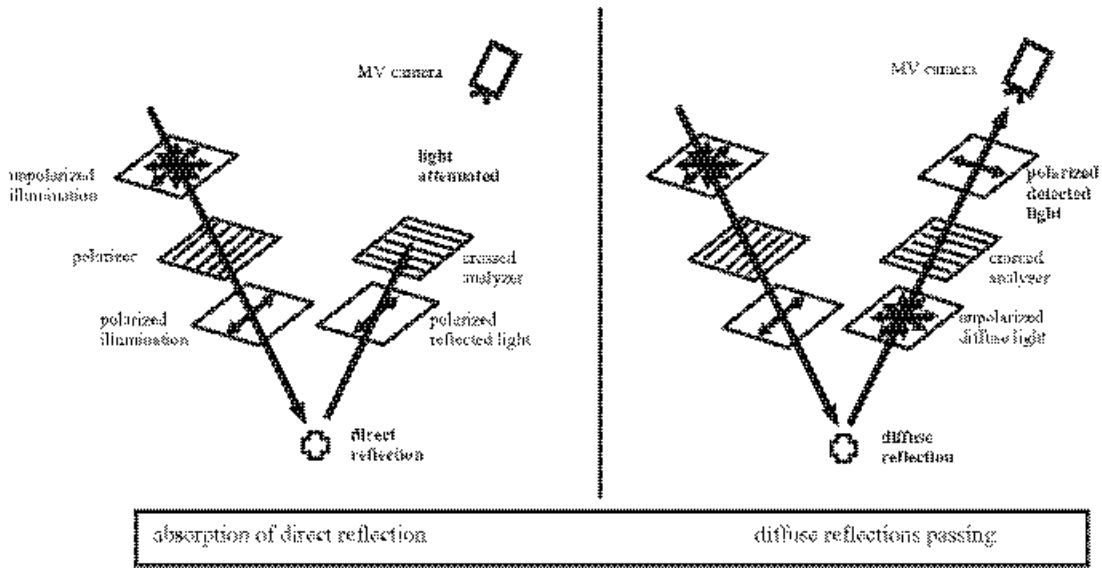
Theory

The electrical field strength of ordinary light vibrates in all possible directions (x, y) perpendicular to the direction of the light propagation (z). It is called unpolarized light.
When unpolarized light enters a linear polarizer, only the light vibrating parallel to the filter's transmission axis (A) passes, while all other parts of the light are absorbed. The transmitted light vibrates in direction (A) only, it is called (linear) polarized light with polarization direction (A).
A second polarizing filter in the optical path, so-called analyzer, absorbs mostly all of the polarized light entering, if it's transmission axis (B) is set perpendicular to the polarizer's axis (A). By turning the analyzer in the (x,y) plane the portion of the light passing through the analyzer can be changed from nearly 0% to nearly 100%.



Using Polarizing kits in Machine Vision and Microscopy

A machine vision system or stereo microscope equipped with incident light illumination detects light reflected from the specimen under investigation. The light entering the specimen can be reflected directly (like mirrors do) or diffuse.
In many cases direct reflections and glare make it impossible to observe the specimen because of their high light intensity. The fact that direct reflections preserve polarized light while diffuse reflections convert it into an unpolarized state, can help to attenuate unwanted glare on the observed specimen:
The specimen have to be illuminated with linear polarized light. The light reflected directly will be still linear polarized, it might just have changed it's direction of polarization.
By turning the following analyzer into a crossed position, most of the direct reflections / glare will be attenuated. The intensity of the direct reflections can be varied by turning the analyzer slightly out of crossed position.
Light reflected diffuse leaves the specimen unpolarized. The portion that vibrates parallel to the analyzer's transmission axis will pass through and can be detected by the camera or microscope.



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Product improvements may result in specification or feature changes without notice.

Notes:

If totally unpolarized light enters a linear polarizer, 50% of the light passes the filter polarized and 50% of the light is attenuated.

If linear polarized light enters a second linear polarizer (analyzer), the portion of the transmitted light can be varied from 0% to 100% by turning the analyzer's transmission axis.

The polarizer must be the last component in the illumination path before the light enters the object while the analyzer must be the first component in the detection path after the light is reflected from the specimen.

Using polarizing kits will attenuate the direct reflections from a mirrored surface to a large extent, but in practice not totally eliminate them. So the reflected image of an illuminating light guide (e.g. a ring light) might still be detectable by a camera. If this is not acceptable, other lighting techniques have to be chosen.

When looking at objects through water, plastic, glassine envelopes or similar materials, polarization will attenuate the reflections from the covering layer and make the specimen observable.

If a material is non-reflective (e.g. blotter paper, textured fabric, woven materials, dull metal or matte finished products) polarizing will probably not enhance the image.

Fibers will not maintain polarization, except fiber types developed specially for that purpose.

SCHOTT offers polarizing kits for ringlights, lightlines, flexible light guides and goosenecks.

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