Session 12

Posters:

COMPUTER COTROLLED MICROSCOPY FOR MICRO-OBJECT SHAPE ANALYSIS

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Micro-object characterization is an important issue in modern industry. Valuable information on quality, performance and production process tuning can be deduced from the geometrical shape of a micro-object. For this reason an accurate geometrical shape determination is of immense practical value. In our research we conducted an investigation of geometrical shape of tapered lensed fibers, as an example of a micro-object. We explore fundamental questions like definition of an edge at the image of a phase object. We address both practical issues like calibration and optical distortions correction and algorithmic issues like edge localization and geometrical features extraction. Additionally, we discuss other important issues like illumination and surface roughness. A number of simple but extra-ordinary techniques, for measurement facilitation, are provided. Possible automation of the characterization procedure is discussed. Finally the possibilities and applicability of this method for geometrical micro-object characterization are discussed.

MODELING OF IMAGE PERCEPTION AND DISCRIMINATION BY THE VISUALLY IMPAIRED

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ABSTRACT

An Image Transceiver based- Goggle has been under development at the Ben Gurion University and the Holon Institute. The device aimed at Low-Vision Aid applications [1], is based on a unique LCOS-CMOS Image Transceiver Device (ITD), which is capable of combining both functions of imaging and Display in a single chip. The head mounted Goggle will allow the capture of ambient scenery, performing the necessary image enhancement and processing, as well as its re-direction to the healthy part of the patient's retina.

In this presentation we will report on the modeling of the imaging, Image Perception and discrimination capabilities of the visually impaired. The first part of the study is based on modeling the spatial frequency response and contrast sensitivity analyzing the two main cases of central and peripheral vision losses. Studies of the effects of both the Retinal Eccentricity and illumination-levels on the low vision's spatial frequency response will be described. The second part of the modeling combines the use of an image discrimination model to assess the ability of the visually impaired using the low vision model outlined above, to discriminate between two nearly- identical images.

[1] Efron U., David I., Apter B., Thirer N., Baal Zedaka I., Ben-Guigui A., Levy O., Nater P. “A head-mounted, image transceiver-based, low vision aid”. Vision 2005 - Proceedings of the International Conference, April 4-7 2005, London, UK. Elsevier International Congress Series, vol. **1282,** 2005 .

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MULTIPLE-FIBER/WAVELENGTH CONFOCAL SENSOR FOR LARGE RANGE DISPLACEMENT AND VELOCITY MEASUREMENT

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In confocal imaging, light is emitted from a small aperture, such as an optical fiber tip, and imaged by low f# optics into a small object volume. The same optics is used to collect the light back scattered from the object, leading to high resolution images widely used in microscopy, surface profiling and displacement sensing.

The high resolution offered by confocal optics generally implies a small depth-of-field which may be a limitation in some applications. We suggest and demonstrate large range sensing by the use of multiple confocal images along the optical axis. This is achieved by the use of multiple fibers at different distances from the optics and/or sensing several discrete wavelengths of light through the fibers. We demonstrate both static imaging of object position and displacements, and dynamic imaging measuring objects moving at high velocities.

APPLICATION OF FREQUENCY DOMAIN OPTICAL COHERENCE TOMOGRAPHY TO THIN FILM OPTICAL METROLOGY

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Frequency domain optical coherence tomography (FD-OCT) is a low coherence interferometric technique where information about the layered structure of the sample is obtained without the need for scanning the pathlength. In particular it allows 3D imaging through scattering media because in such media, multiple interference effects are ignored. The interferrogram is spectrally synthesized using a spectrometer and the spectral output is Fourier transformed to reveal the layered structure. The technique has been applied successfully to biomedical applications with the advantage of being fast as compared to the time domain OCT which requires scanning of the pathlength. Our aim in this work is to evaluate the suitability of the FD-OCT for optical metrology applications particularly thin film measurements in spite of the existence of multiple interference effects. Results will be presented showing the limits and advantages of this approach as compared to other existing techniques such as reflectometry and ellipsometry.

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