Dirección de Formación Académica

CENTRO DE INVESTIGACIONES EN OPTICA, A.C.

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Tesis: "3D SCANNING OF OBJECTS BY DISPLACEMENT OF LIGHT LINES AND STUDY OF THEIR PROFILE"

Resumen:

This thesis presents three different optical systems for digital tridimensional reconstruction of objects using the displacement of light lines technique. System 1: 3D scanning of objects was carried out through the projection of one light line with profiles of type Gaussian, triangular and sinusoidal. Appropriate algorithms were implemented for each type of light line profile. The efficiency of each profile was evaluated in terms of precision and processing time. System 2: 3D scanning of objects by projection of three color lines (red, green and blue) with a Gaussian profile. Color lines simultaneously scan different zones of the object with the purpose of optimizing the capture time and the number of stored images, compared to the projection of one light line. System 3: 3D scanning of objects by color structured multi-line projection with Gaussian profile was proposed. The technique consists of projecting a set of gratings with equidistant parallel lines of color red, green, and blue on the object to be reconstructed. The displacement of the color lines is obtained through image processing by skeletonization in the R, G, and B color channels. The displacements of the color lines of each grating are combined to obtain the complete shape of the object.

The results suggest the use of light projection with Gaussian profile to obtain more accuracy in the topography measurement, and the use of light with triangular profile to considerably improve the processing time and to obtain fast results. The criteria for choosing the proposals given in this thesis for scanning objects will depend on the complexity of the surface of the object and the requirements of the application, in case a high precision or speed of measurement is needed in the scanning. Illustrative examples of the obtainable experimental results are presented and discussed.