

Three dimensional shape metrology by using red, green and blue channels

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Summary

Optical full-field fringe projection techniques have been widely studied in academia and applied to many actual industrial fields of automatic inspection, reverse engineering, heritage protection, cosmetic surgery, and so on. With the advent of color CCD cameras and Digital Micromirror Device (DMD) based color Digital Light Processing (DLP) projectors, their major red, green and blue channels have been used as a carrier to code fringe patterns. Since three fringe patterns can be simultaneously projected and captured by a color image, the acquisition time reduces to 1/3 of the value by projecting only gray fringe patterns. This talk introduces two kinds of applications of red, green and blue channel as a carrier. One is coding sinusoidal fringe patterns into red, green and blue channels of a composite color image; the other is coding sinusoidal and binary fringe patterns into the RGB channels of multiple composite color images. The generated composite image is simultaneously projected from the DLP projector. The color CCD camera captures the three deformed fringe patterns as a color image from different viewpoint. After compensating for the crosstalk and chromatic aberration between color channels, three fringe patterns can be demodulated from a captured color image. Phase map and then shape data are calculated from the extracted fringe patterns. Experiments on measuring the shape of objects' surface by using the three color channels were carried out. The experimental results confirm the validity of red, green and blue channels as a carrier to reduce the acquisition time.

