

# 3-D Deformation Measurement Using a Grid of Circular Dots

羅鵬飛, 徐忠義

Mechanical Engineering

Engineering

luo@chu.edu.tw

## Abstract

In the paper a stereo vision is calibrated using a grid of circular dots so that the calibrated system is able to measure the deformation field of a material with micron measurement accuracy. The center positions of circle dots were used as calibration points. Since the projection of a circle dot on the image plane is an ellipse, the relationship between the center of the circle dot and the center of the ellipse was obtained mathematically in the paper to reduce the bias between the camera model and the observed center of the ellipses. In addition, both of the radial and decentering lens distortions are included in the camera model equation to improve the accuracy of the model equation. After camera calibration, the tensile tests on the double-dot and dot-grid specimens were conducted and the calibrated stereo vision was used to measure the deformation field of the specimens and calculate the axial strain, lateral strain, and Poisson' s ratio to evaluate the ability of the stereo vision to measure a deformed body.

Keyword : circular dot, stereo vision, camera calibration, lens distortion coefficient