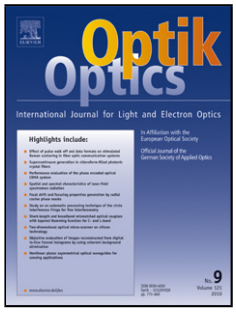

Title: An accurate calibration method for non-overlapping cameras with double-sided telecentric lenses

Author: Banglei Guan Linshen Yao Haibo Liu Yang Shang

PII: S0030-4026(16)31492-9
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2016.11.156
Reference: IJLEO 58572

To appear in:

Received date: 19-1-2016
Accepted date: 28-11-2016

Please cite this article as: Banglei Guan, Linshen Yao, Haibo Liu, Yang Shang, An accurate calibration method for non-overlapping cameras with double-sided telecentric lenses, Optik - International Journal for Light and Electron Optics http://dx.doi.org/10.1016/j.ijleo.2016.11.156

An accurate calibration method for non-overlapping cameras with double-sided telecentric lenses

Banglei Guan [a, b, *], Linshen Yao [a, b], Haibo Liu [a, b], Yang Shang [a, b]

[a] College of Aerospace Science and Engineering, National University of Defense Technology, Changsha, Hunan, 410073, China;

[b] Hunan Provincial Key Laboratory of Image Measurement and Vision Navigation, Changsha, Hunan, 410073, China

Corresponding author: banglei.guan@hotmail.com

Abstract: In the application of displacement-relay videometrics for surface subsidence surveillance, double-sided telecentric lenses are especially suited as their constant perspective and large magnification among depth of field. As a serial camera network, it is necessary to calibrate the geometrical relationships between rigidly linked cameras in displacement-relay videometrics. Hence a calibration method for non-overlapping cameras with double-sided telecentric lenses is first proposed. The proposed method utilizes several laser planes, which can be generated by a line laser projector, as the calibration objects. The method connects the double-sided telecentric cameras using the coplanarity of laser plane which goes through the FOVs of cameras. It does not require high-precision 3D measurement equipment, but only requires an ordinary line laser projector and two plane patterns. Real data experiments are performed to validate the proposed method. The experimental results show that the given method is quite reliable and accurate, which can be used to calibrate geometrical relationships of double-sided telecentric cameras in displacement-relay videometrics.