AN APPARATUS AND A METHOD OF RECORDING AN IMAGE OF AN OBJECT

The invention relates to a method of recording an image of an object (103) using an electronic camera (102), one or more light sources (104), and means for light distribution (105), where light emitted from the light sources (104) is distributed to illuminate the object (103), light being reflected to the camera (102). In the light distribution, an integrating cavity (106) is used to whose inner side (107) a light reflecting coating has been applied, and which is provided with first and second openings (109, 110). The camera (102) is placed in alignment with the first opening (109) so that the optical axis of the camera extends through the first and second openings (109, 110). The object (103) is received in the second opening (110), and the interior of the integrating cavity is illuminated using the one or more light sources (104). The invention also relates to an apparatus for performing the method.

On chromatic and geometrical calibration

The main subject of the present thesis is different methods for the geometrical and chromatic calibration of cameras in various environments. For the monochromatic issues of the calibration we present the acquisition of monochrome images, the classic monochrome aberrations and the various sources of non-uniformity of the illumination of the image plane. Only the image deforming aberrations and the non-uniformity of illumination are included in the calibration models. The topics of the pinhole camera model and the extension to the Direct Linear Transform (DLT) are described. It is shown how the DLT can be extended with non-linear models of the common lens aberrations/errors some of them caused by manufacturing defects like decentering and thin prism distortion. The relation between a warping and the non-linear defects are shown. The issue of making a good resampling of an image by using the correct interpolation method is described. For the chromatic issues of calibration we present the acquisition of colour and multi-spectral images, the chromatic aberrations and the various lens/camera based non-uniformities of the illumination of the image plane. It is described how the monochromatic calibrations are extended to multi channel images. Since accurate colour images require equal (uniform) intensity levels in all channels, the various sources, in both open and closed scenes, for the non-uniform intensities and some corresponding calibration methods are described. The various possibilities to design calibration targets for both geometrical and chromatic calibration are described. We present some possible systematical errors on the detection of the objects in the calibration targets, if viewed in a non orthogonal angle, if the intensities are uneven or if the image blurring is uneven. Finally we present the implementation of a complete calibration method for an accurate colour texture measurement device called VMX2000, the calibration for uneven laser sheet illumination in a flow measuring system and the use of automatic detection of calibration targets for a DLT/warping in a 3D PIV system.
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Organisations: Department of Energy Engineering, Department of Informatics and Mathematical Modeling, Burmeister & Wain Energ A/S
Authors: Matlok, S. (Intern), Scheel Larsen, P. (Intern), Gjernes, E. (Ekstern), Folm-Hansen, J. (Intern)
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Projects:

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Department of Informatics and Mathematical Modeling
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Number of participants: 5
Project participant:
Hartelius, Karsten (Intern)
Frederiksen, Martin Stig (Intern)
Dørge, Thorsten Carlheim (Intern)
Quantification of enzymatic effect
Department of Informatics and Mathematical Modeling

Novo Nordisk A/S
Period: 01/01/1996 → …
Number of participants: 2
Project participant:
Folm-Hansen, Jørgen (Intern)
Project Manager, organisational:
Carstensen, Jens Michael (Intern)
Project

Eksplorativ simulation af komplekse stokastiske systemer

Administration
Period: 01/02/1995 → 31/07/2000
Number of participants: 3
Phd Student:
Folm-Hansen, Jørgen (Intern)
Main Supervisor:
Conradsen, Knut (Intern)
Examiner:
Dueholm, Keld (Intern)

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Period: 01/02/1995 → 31/01/1999
Number of participants: 2
Project participant:
Folm-Hansen, Jørgen (Intern)
Project Manager, organisational:
Conradsen, Knut (Intern)