

Anton Palamarchuk  
A.S. Kuchin, research supervisor  
M.L. Isakova, language adviser  
National Mining University, Dnipro, Ukraine

## **The Creation of the Stand for Calibration of Digital Images for their Further Vectorization**

In recent years there was a large technological and engineering revolution in the field of the digital photo that led to considerable improvement of quality of digital cameras and pictures. Improvement of quality of the image is combined with depreciation of cameras depending on the present prices of the special equipment applied in geodesy. As a result, we as engineers had an opportunity to use digital cameras as the geodetic measuring tool.

Now, to increase the efficiency of surveying quality and geodetic shootings, it is necessary to use new methods and technologies of shootings and their processing. One of the most perspective methods is shooting with digital cameras, which allows to refuse expensive special devices.

To study errors of optical systems, the analysis of research in this direction, theoretical justification of process of measurement, we created the stand for calibration of digital pictures (big plans of mining operations) by means of digital cameras for the purpose of their further vectorization.

### *Creation of the stand*

One of perspective methods of picture calibration, and, above all available under our conditions, the method is based on determination of characteristics of the central projection of pictures and its distortion according to photos of the special stand or the control site of the area on which coordinates of X Y Z are determined.

The place for the calibration stand was chosen on a wall of one of educational audiences. Dimensions of the stand are 841 mm x 1189 mm (9 x 11 squares).

The wall is divided into a grid of 100 X100 mm. In the grid nodes will be assigned to marking crosses.

For the solution of a problem of calibration of pictures – it is necessary to know spatial coordinates of X Y Z all points of the ground.

Therefore, the first stage in a research and in the achievement of an objective is carrying out measurements of the test bench for the purpose of finding of their coordinates of all knots in conditional system of coordinates.

In our case the following directions of axes of coordinates will be chosen:

- OX axis - along ranks of a grid;
- OY axis - along lines of a grid;
- OZ axis - perpendicular to a wall.

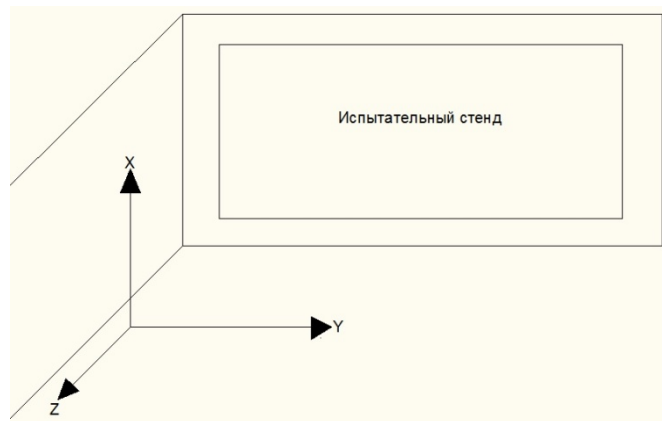


Fig 1. Orientation of the stand

### *Measurement of distances between nodal points*

The control meter will be used as the measuring device. The technology of measurement will be considered on the example of one square of the test bench.

All parties and diagonals will be measured in a square 0,1-0,2-1,1-1,2. Counting on rulers undertakes with an accuracy of 0,2 mm.

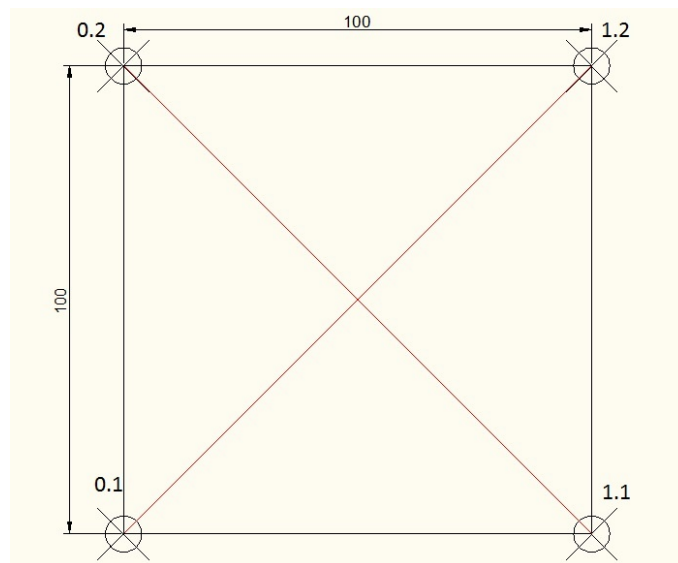


Fig. 2 Stand Grid Cell

### *Shooting of the test bench*

For a certain period several series of photographing of the stand will be carried out: the first series of shooting will be done by the mirror digital Canon EOS 550D camera with various lenses with focal length - 18-55 mm of Kit, 50 mm 1.8, 200 mm, and also several low budget cameras, such as – Panasonic DMC-F2. As a result of measurements, coordinates of control points of the stand in conditional system of coordinates will be received.



Pic 3. Canon EOS 550D

## Technical characteristics of Canon EOS 550D

Matrix	22.3 × 14.9 mm
Resolution	5184 × 3456
Lens	interchangeable lens with a bayonet joint of Canon EF/EF-S
Shutter	with electronic control and vertical movement of blinds in the focal plane
Exposure	63-zonal TTL measurement at completely open diaphragm
Focusing Area	9-pointed autofocusing
Serial Shooting	3.7 frames per second
ISO Range	100 — 6400 with a step 1/3 or 1 EV, expansion to 12800
Balance Of White	automatic, daylight, a shadow, it is cloudy, the glow lamp, a white fluorescent lamp.

It conclusion, it should be noted that the high cost of special equipment which allows transforming big plans of mining operations with the smallest error – causes special financial difficulties, both in the enterprises, and the small private organizations. Therefore, we consider the possibility of using simple, household cameras for the high-precision decision on pictures of measuring tasks as a good solution to this problem.