Photogrammetric study of curved surfaces of monuments Examples of the historical center of Mystra.

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1. Introduction

The preservation of the cultural inheritance of every country is its very first obligation. On this purpose a multiple study of monuments and historical centers is entirely necessary. To attempt this the methods of Photogrammetry and Photointerpretation are of great importance.

Photointerpretation and photogrammetric exploitation of airphotographs, terrestrial takings for general presentation, takings from near places (external, internal) and several kinds of restitution (graphical, analytical, rectification, orthophotography) were the subjects of our study of various monuments and historical centers of Greece (1-11).

Particular interest for photogrammetric study is put on the architectural parts of monuments, which include curved surfaces, especially when they have paintings and/or they present several kinds of damages (crevices, deformations etc.).

We usually meet these curved surfaces, except other cases, in the internal areas of churches, their study of which is especially important for Greece.

In this paper we attempt a preliminary study on the internal areas of the Cathedral at the historical center of Mystra (Peloponnesus, Greece).

2. Study of the curved surfaces.

From the two barrel-vauts, the eastern one was covered by painting destroyed at great extent.

The paintings are completely destroyed at the central barrelvault, which presents serious crevices.

At both cases with geometric dimensions drove to the use of stereocamera with which the takings were successively done. (Fig.1-3). Suitable targets, four at each case, were placed at the corners of the subject, the coordinates of which were reported at trisorthogonal system, beginning with one of them and horizontal axis, x, ψ (indicative dimensions are presented at Fig. 1 (1-2 2,77 m), Fig. 4 (1-2 2,80 m).

The restitution of the eastern barrel-vault was considered purposeful to be done with orthophotography. The orthophotography at scale 1:20, Fig. 2 was done with Topocart orthophot Iena.

At the case of the central barrel-vault, a graphical restitution was done at scale 1:20. Characteristic architectural details and crevices were restitued in alignment Fig. 4, I-II, a, b, c, and contour lines were been drawn, Fig. 4, 0-56 cm.





Fig. 1. One photograph of the stereoscopic pair of the southern barrelvault. Fig. 2. Orthophotograph at scale 1:20 from the pair of Fig. 1 (Reduction).

The considerations about digital models in the photogrammetric research and practice present contineous interest. Terrain-geomorphology and various kinds of technical works consist the main directions for relevant studies. However, we consider that the study of architectural parts may be also multiply served with digitals. On this purpose, a satisfactory research and facing of all the particularities, which are presented at the study of the architectural parts, can be obtained with a systematic approach of the problem, with evaluation and exploitation of the existing experience about digitals.

The use of a square grid of sampling points was considered useful in the present paper for the beginning of such a study.

The sampling points, at which we measured altitudes, were taken at the grid sections every 2 cm at the scale of the drawing.

Of course, the density of the sampling points can vary according to the case for all the net or locally for a more detailed description.

Furthermore other kinds of digitals can be searched through.

Using the suitable program we can have various products as contour, curves, sections, perspectives etc.

Parts of contours, which were drawn on base of the program that was edited for this reason, are presented at Fig. 4, 1-8. A satisfactory at principal corresponding with the curves of the graphical restitution is confirmed.

The program for digital models, as it was used at this preliminary form, included the study of the surface of the model on every square-cell at the center of which the altitude was corresponded to the average of the altitudes of the four apexes of the square.



Fig. 3. One photograph of the stereoscopic pair of the western barrel-vault.



Fig. 4. Photogrammetric restitution at scale 1:20 from the pair of Fig. 3 (Reduction).

The course of every contour was searched through in each cell with the possibility of smoothing of its parts.

3. Conclusions - Discussion.

Curved surfaces, among the various architectural parts of a church, are of particular interest and they present increasing requirements at the photogrammetric survey.

The interest is growing because these areas are usually covered by paintings. Then, the photographic images present deformations because the taken photograph is central projection of a curved surface. Various methods (developments etc.) can principally be used for the photogrammetric survey - restitution at similar cases. However, orthophotograph, which is reseased of the above deformations, offers at principal some advantages because it is a photographic metric document at orthogonal projection, including much information.

The study of damages and of deformations of architectural parts because of various reasons, their attendance, our interference and their restoration is an extremely interesting direction of the study of monuments. Especially taken care of topographic and photogrammetric works are being required in order to have results of increasing accuracy. At the case of this study, the plotting of the crevices and the study of the relevant curves give first interesting information about the damages and the relevant deformation of the surfaces.

Taking and suitable elaboration of digitals seem that they may serve the study of the curved surfaces of the architectural parts (basic form and partial deformations) and give multiple useful results from the aspect of automatism (curves, profiles, perspectives etc.), storage, filing, etc.

This study is a preliminary facing of the problem of the photogrammetric study on curved surfaces of the architectural part of monuments. It took place with the means of the existing equipment of which the suitable evaluation and the use of its possibilities are realistic and positive consideration which offer experience for further research of the subject and serve better the whole problem of the study of monuments and historical centers.

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