Methodology of 3D Measurement - Case Study in the Main Church of Sopocani Monastery, Southern Serbia -

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Aim of study

This paper deals with the methodological challenges of 3D scanning of the main church of Sopocani Monastery (hereafter called Sopocani church)[Fig.1], the world cultural heritage in southern Serbia. Accurate documentation of the heritage is the fundamental basis of scientific analyses as well as its conservation. 3D scanning, with rapid development both in hardware and software during last decades, has been applied in the field of the heritage study with different range of accuracy and scale.

In some cases, however, the requirement of survey and the delicacy of the heritage may cause particular difficulties, even though 3D scanning enables us to reach such part where measurement could not be carried out otherwise. This paper shows challenges of heritage scanning, taking Sopocani church an example of historical structure of stone. The scanning data of this church, threatened of decay, should constitute an effective base for the future conservation project.

Method of study

Two types of 3D measurement were carried out: the laser scanning (Riegl VZ400) and the LED scanning (Artec Spider).

Approach

The laser scanner is effective for architectural space, while the LED scanner is suitable for details of the surface, though the view-field of the latter is limited to 180×140mm. The combination of these two apparatus of different scale is indispensable for measuring the historical structure, the value of which exists both in architecture and in surface. In Sopocani church, 23 laser scans were carried out in measuring inside/outside of the structure, and 477 LED scans were carried out in measuring west wall of naos. The mural painting of Sopocani church is uniquely characterized by the golden background made of numerous gold leaves. As the gold has turned almost invisible because of degradation, the art-historical research of its iconography would be possible only through the accurate detection of the minute thickness change of paint layers by LED scanner.

Outcome

The laser scanning data indicate relatively small variation of the thickness of the wall of the church, 0.957-1.001m, which may prove the quality of the original construction[Fig.2]. Regarding the porch, added later, there is a difference of 0.784m in width. Columns of the porch show outward inclinations, being 7 degree at the most[Fig.3]. If such inclinations, already confirmed by the author in old photographs as well, should be monitored together with the deformation of the arches, the scanning data are of fundamental importance. The data clearly indicate the difference of building quality between the original and later extension.

LED scanning data have shown certain hidden painting technique and characteristic depiction of the west wall of naos (12.811×6.323m), where saints and angels are painted[Fig.4]. Analysis of scan data has revealed that position of the aureoles of saints is different in lower and upper part of the painting. In lower part, centers of aureoles are placed around the temple, while they are placed around the forehead in higher part. The faces are slightly longer in upper part. We may presume that painters adopted this technical device as they were conscious of the figures to be looked up by people standing on the ground floor. LED scanning also clarified unique depiction in Sopocani church: fine grid pattern is obvious on the

golden background of the alter, which is supposed to be mosaic-imitation. The same pattern is also found in the west wall of naos.

Conclusion

3D measurement is an effective method for the documentation of the architectural heritage. In Sopocani church the scanning measurement clarified the quality of the original construction. The LED scanning has shown particular technique and devices of painters. 3D measurement will be useful for the monitoring of the heritage structure as well.

Keywords: 3D measurement, Cultural Heritage, Serbia
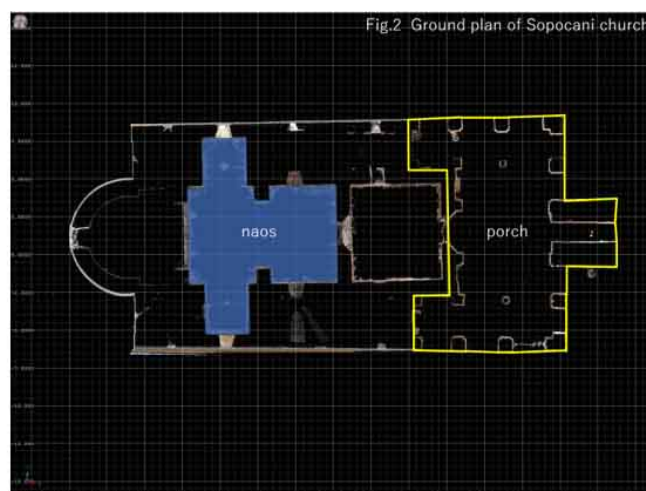

Fig.1 Sopocani church
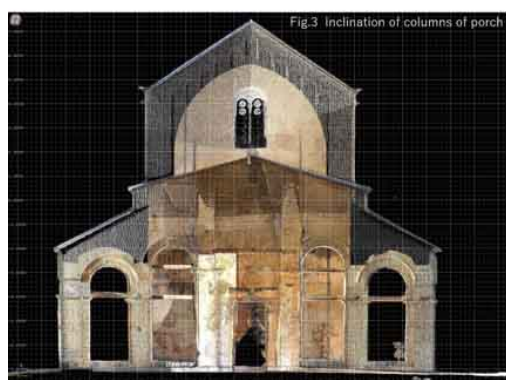

Fig.2 Ground plan of Sopocani church
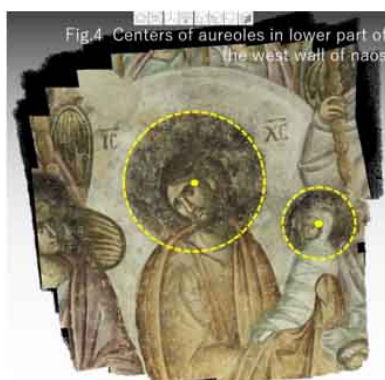

Fig.3 Inclination of columns of porch

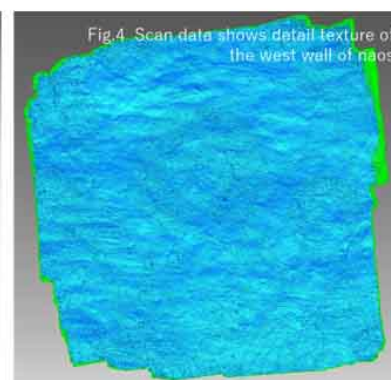Fig.4 Centers of aureoles in lower part of the west wall of naos

Fig.4 Scan data shows detail texture of the west wall of naos