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DESIGN OF THE "FROM THE CORNER" PERSPECTIVE IMAGE OF THE FAÇADE PLANE OF ARCHITECONIC OBJECTS, BY BRINGING THE GENERAL COLINEAR FIELD FROM GENERAL INTO PERSPECTIVE POSITION

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Abstract. *The paper treats the problem of the simpler design of the perspective image of the façade plane of the new achitectonic object, which needs to be placed into the empty space in the row of street façades on the photograph provided for the object. The method of bringing the general colinear fields from general into perspective position, by the rotation and translation of a field, can be the solution to the problem. General invariants are determined in the general position of the field – appended identical tufts of the straight lines, whose tops are the focuses. Copying is performed in the perspective position of the field, which is obtained by coinciding of a pair of appended focuses. After being designed, the perspective image of the façade can be placed into the space on the photograph, which is provided for the new object.*

Key words: *general and perspective position of the general colinear fields, perspective image of the façade, plane projection of the façade.*

INTRODUCTION

There is an empty space provided for the new object on the photo of a row of street façades, for which there is a project with measurements that can be used. One should use the plane projection of the façade plane, the basis of the new-projected object and the position of the view point to design the perspective image of the façade plane of the new object by the system of coordinates method. This paper will demonstrate how it is possible to design the perspective picture of the façade plane of the new object in the empty space on the photograph, where only the plane projection of the façade is used.

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1. APPLICATION OF THE "FROM THE CORNER" PERSPECTIVE IMAGE OF THE NEW OBJECT FAÇADE WITH THE PLANE FAÇADE PROJECTION

Figures no. 1. 2. 3. 4. 5. 6. and 7. display the practical application of the method of bringing the general colinear fields from the general into the perspective position, by using the rotation and translation of a field, in order to design the "from the corner" perspective image of the façade plane of the new object which ought to be placed in the empty space on the existing photograph.

Figure 1. shows the photograph of a row of street façades, with an empty space intended for the new object. There is a project for the new object, from which the street façade is used (plane projection). By using this method it is possible to design the perspective image of the façade solely with the plane projection of it, without determination of the view point.

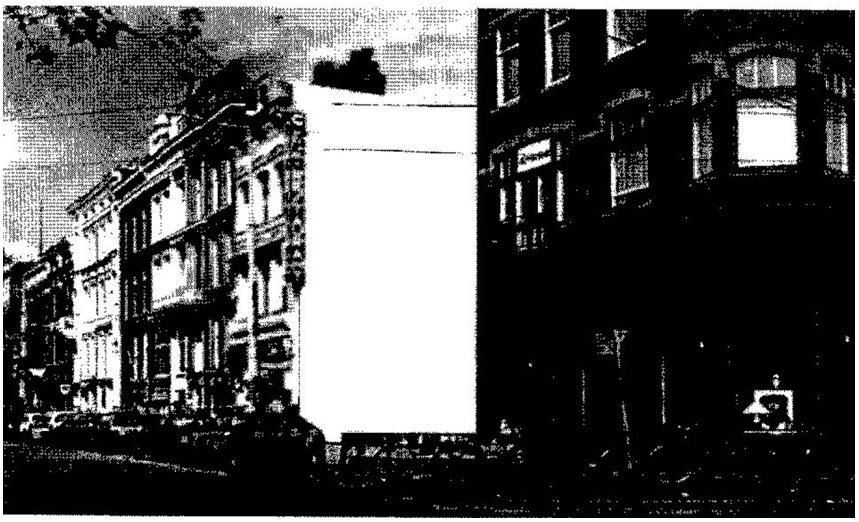

Fig.1.

Figure 1.1. general field position

Figure 1. has four designated points A, B, C, D by which the P field (perspective image of the façade) is determined.

Its appended field $\overline{P}$ (plane projection of the façade), is determined by the four points $\overline{A}$, $\overline{B}$, $\overline{C}$ and $\overline{D}$ (fig. 2.). In this manner, the colinear relation of the two fields is established, because these are four couples of the uniform appended points of. Both fields P and $\overline{P}$, are taken in the small scale, which may not be taken as a rule in practice.

Figure no. 2. displays the general position of the fields P and $\overline{P}$. The invariant elements are determined in the general position, those being the vanishing straight lines $_1$n and $\overline{n}$ and the principal normal ng and $\overline{ng}$, by complementing the projective series with the perspective cones of rays (N∞) and ($\overline{N\infty}$) i the axis of the perspective p_1(CD) and p_2(AB). With other invariants, it is sufficient to determine the identical appended members of the straight lines.

The tops of the identical appended tufts (focuses) are determined by the special procedure, where we use the equal angles formed by the rays in the identical appended tufts and the corresponding vanishing points and the principal normal, (see the S. Krasic's MA paper, page 37). In this way, two couples of appended tops of the identical tufts of the straight lines are obtained, which are at the same time the focuses, F and F_1 in the field P, and corresponding focuses $\overline{F}$ and $\overline{F}_1$ respectively. There is a possibility to determine the identical appended series in the general position of the field, but for the sake of the simpler design in the paper, only the dual variant with the identical appended tufts of the straight lines are considered.

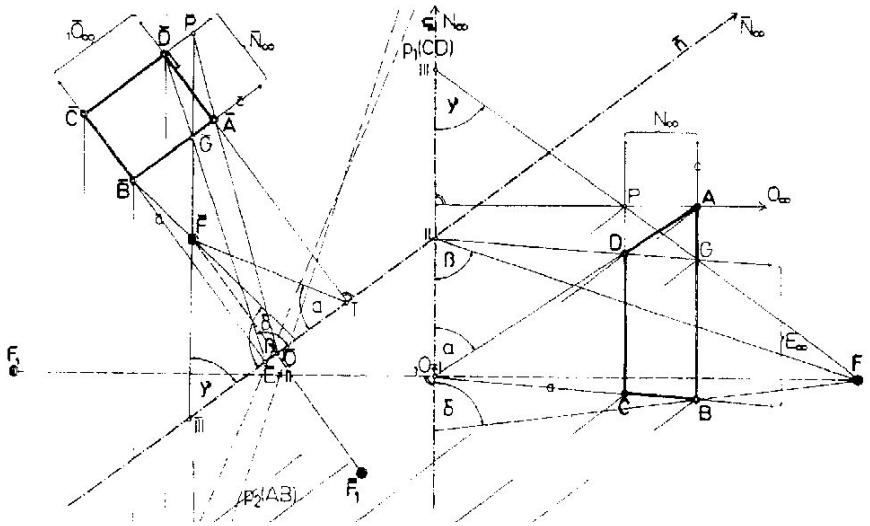

Fig. 2.

1.2. Perspective position of the field

Using the rotation and translation of a field (in this case it is $\overline{P}$), the perspective position of the field P and $\overline{P}$ (fig. No. 3., 4., 5. and 6.) is obtained. The appended couple of the identical tufts of the straight lines (F) and ($\overline{F}$), (fig. 3 and 4.) coincide with the appended couple of the identical tufts of the straight lines (F_1) and ($\overline{F}_1$), (fig. 5. And 6). In this way, the centre of perspective $S \equiv F \equiv \overline{F}$ and the axis of perspective s are obtained in two variants on the figures no. 3 and 4., and the centre of perspective $S \equiv F_1 \equiv \overline{F}_1$ and the axis of perspective s in the remaining two variants on the fig no. 5 and 6. Copying from the $\overline{P}$ field into the P field in the perspective position of the fields, can be performed simply. The connecting lines of the appended points pass through the centre of the perspective, and the appended straight lines intersect on the axis of perspective. The plane projection of the street façade plane is copied in the perspective image of itself, but in the perspective position.

The invariants of the perspective position of the colocal general colinear fields represent the following elements for the perspective image of the façade plane: coinciding principal normals ng ≡ $\overline{ng}$ represent the vanishing point of the horizontal planes (the horizon line), and the centre of the copied absolute involution in the field P, $_1O$ is the vanishing point of the direction a on the façade plane. For the direction of the vertical lines, the vanishing point on the perspective image is the infinitely distant point N∞ ≡ $\overline{N}$∞ . All these elements are taken into account for the from-the-corner perspective, and the oblique perspective will be the subject of further researches.

1.2.1. The coincident appended identical tufts of the straight lines (F) ≡ ($\overline{F}$)

1.2.1.1. In the first variant of the perspective position which gas been determined by the coincidence of the appended couple of the identical tufts of the straight lines (F) ≡ ($\overline{F}$), (fig.3.) the field P (perspective image of the façade) and the field $\overline{P}$ (plane projection of the façade) are laid contrary to the horizon line (ng ≡ $\overline{ng}$) – positive directions of the vertical lines c and $\overline{c}$ are counter oriented in respect to ng ≡ $\overline{ng}$. During the copying one must take care about the position of the points and straight lines. In this example, the position of the centre of perspective S in respect to the points and straight lines of both fields in the perspective position is more favourable than the position of the axis of perspective s, so the copying is performed by the centre, while the axis stands for the control. The points of one field are laid contrary to the points of another field in respect to the axis of perspective s.

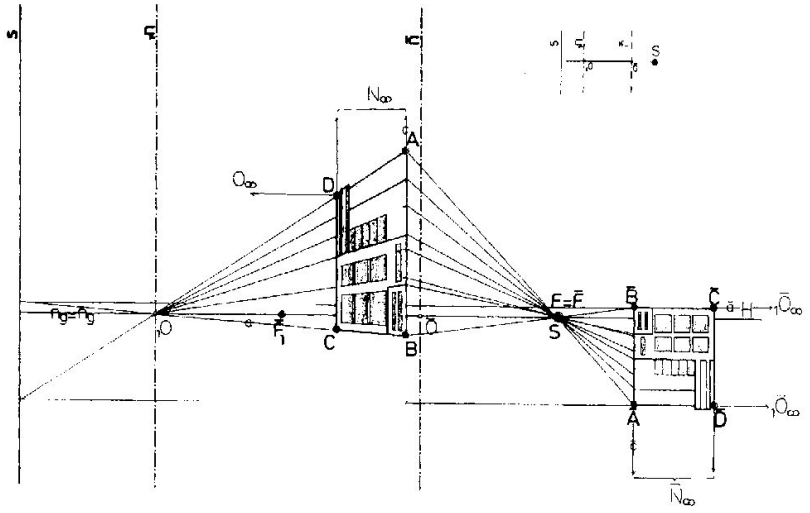

Fig. 3.

1.2.1.2. In the second variant of the perspective position of the field, obtained by coinciding the identical tufts of the straight lines (F) ≡ ($\overline{F}$) (fig.4), the fields P and $\overline{P}$ are also laid in respect to the horizon line (ng ≡ $\overline{ng}$) – positive directions of the vertical lines

c and $\bar{c}$ are oriented in respect to ng ≡ $\overline{ng}$ in the same way, so the copying is clearer. It is possible that, in this variant, depending on the size of the determined fields, the perspective image and the plane projection of the façade should coincide, as in the example, so the perspective position is without the clear layout. The position of the S centre and s axis of perspective in respect to the points and straight lines in this variant is favourable, so the copying from $\bar{P}$ into P field is performable by both elements equally.

1.2.2. The coincidence of the identical tufts of the straight lines (F_1) *and* ($\bar{F}_1$)

1.2.2.1. In the first variant of the perspective position obtained by coinciding of the appended identical tufts of the straight lines (F_1) ≡ ($\bar{F}_1$), (fig. 5) the need to position the $\bar{P}$ field orthogonally-symmetrically in respect to the coinciding principal normals in order to obtain the perspective position is unfavourable. The P and $\bar{P}^0$ fields are equally laid in respect to the horizon line (ng ≡ $\overline{ng}$) – positive directions of the vertical lines c and $\bar{c}$ are oriented in respect to ng ≡ $\overline{ng}$. In this example, the position of the centre of perspective S in respect to the points and straight lines of the both fields is less favourable than the position of the axis of perspective s, so the copying is performed by the axis of perspective, and the S centre is used for checking (connecting lines of appended points pass through S centre). The points of one field are laid contrary to the points of another field in respect to the axis of perspective s.

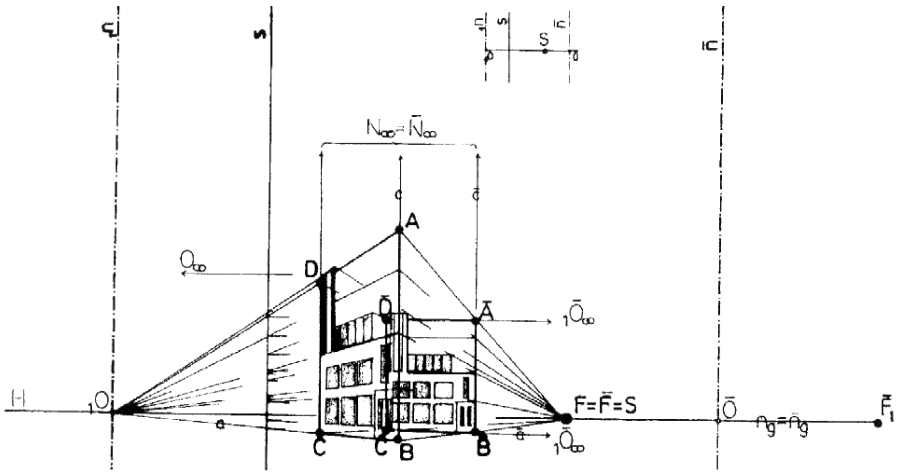

Fig. 4.

1.2.2.2. In the second variant of the perspective position of the field obtained by coinciding of appended identical tufts of the straight lines (F_1)≡($\bar{F}_1$), (fig. 6) the field $\bar{P}$ must be laid orthogonally-symmetrically to the coinciding principal normals, in order to obtain the perspective position of the field, as in the preceding variant. The P and $\bar{P}^0$ fields are laid contrary to the line of horizon (ng ≡ $\overline{ng}$) – positive directions of the vertical lines c

and $\bar{c}$ are oriented contrary in respect to the $ng \equiv \overline{ng}$. The position of the points and straight lines of both fields is unfavourable both in respect to the centre of perspective S and the axis of perspective s. Because of the copying it is necessary to display both fields in small scale, which affects the precision of the design. The points of one field are laid contrary to the points of another field in respect to the axis of perspective s.

Through consideration of every of this variants it is concluded that the most favourable variant for copying in the perspective position of the field is the second variant of coinciding the appended couple of the identical tufts of the straight lines $(F) \equiv (\overline{F})$, 1.2.1.2. (fig. 4).

The perspective image of the façade plane of the new object is designed and can be placed into the frame on the photograph (A B C D field at fig. 7).

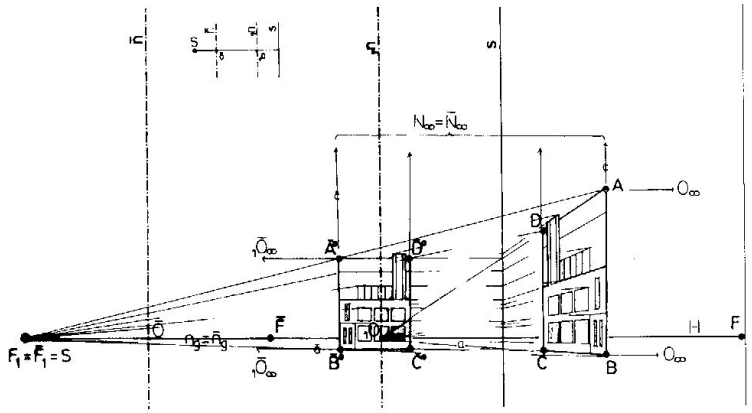

Fig. 5.

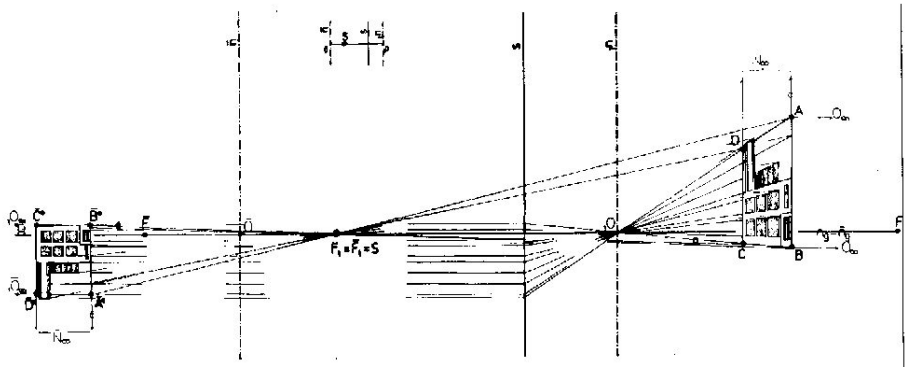

Fig. 6.

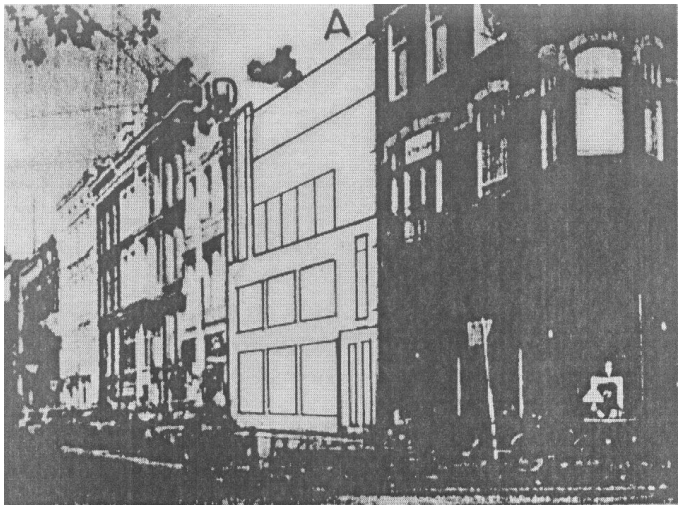

Fig. 7.

CONCLUSION

When there are two general colinear fields in the perspective position, the design procedure of copying is shortened, which contributes the practical solving the Perspective and Synthetic geometry problem. Instead of using the known procedures, this method enables the significant simplification of the design of one "from the corner" image of a new object which is placed in the frame of the existing objects.

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KONSTRUISANJE PERSPEKTIVNE SLIKE "S UGLA" FASADNE RAVNI ARHITEKTONSKOG OBJEKTA, DOVODJENJEM OPŠTE-KOLINEARNIH POLJA IZ OPŠTEG U PERSPEKTIVNI POLOŽAJ

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U radu je razmatran problem jednostavnijeg konstruisanja perspektivne slike fasadne ravni novog arhitektonskog objekta, koju je potrebno smestiti u prazan prostor uličnog niza fasada na fotografiji, predvidjenog za taj objekat. Za rešenje problema može se iskoristiti metoda dovodjenja opšte-kolinarnih polja iz opšteg u perspektivni položaj, rotacijom i translacijom jednog polja. Polje tačaka perspektivne slike fasadne ravni je u opšte-kolinearnoj vezi sa poljem tačaka ortoganalne projekcije te iste fasade. U opštem položaju polja odrede se invarijante-pridruženi identični pramenovi pravih, čija su temena žiže. Preslikavanje se vrši u perspektivnom položaju polja, koji se dobija poklapanjem jednog para žiža. Pošto je konstruisana, perspektivna slika fasade može da se smesti u prostor na fotografiji, koji je predviđen za novi objekat.

Ključne reči: *opšti i perspektivni položaj, opšte-kolinearna polja, perspektivna slika fasade, ortogonalna projekcija fasade.*