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IMPLEMENTING A RECTANGULAR AXONOMETRY USING THE METHOD OF G. MONGE

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In engineering practice, one can often come across axonometry of the developed structure, in particular as a complementary drawing. In the literature, there are axonometry definitions which differ from each other, each of which is sufficient in the case where, on its basis, a reference drawing which constitutes a supplementary documentation is to be created e.g. by means of the Monge's projections.

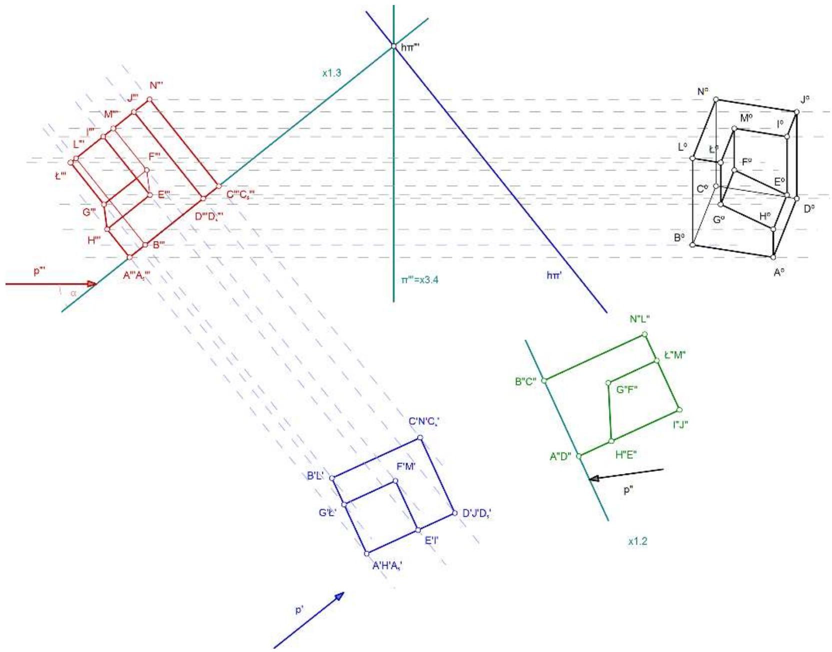

Fig. 1. An example of the use of the transformation in the G. Monge's projecting as a method for obtaining a block "axonometry".

If, however, this projecting method is treated as a separate method of projecting which allows solving spatial problems, not all definitions and structures that followed them give us unambiguous and reversible results, and the mutual uniqueness of the method is, in this situation, a primary issue. Axonometric projection is divided into two types - rectangular and oblique which differ from each other in the direction of the space projection on a basic projection plane π. Karel Pelz is considered to be a creator of rectangular axonometry and the comprehensive assumptions can be traced in the work of his assistant Rudolf Schüssler titled: *"Orthogonale Axonometrie. Ein Lehrbuch zum Selbststudium"*. In this work, written in 1905, rectangular axonometry, for disambiguation purposes, is complemented by projections on the additional plane defined with coordinate axes.

A structure proposed here deviates from the spatial representation by means of Cartesian coordinate axes. Using the method of the Monge's projection, it allows the execution of the image which can both be used as a complementary drawing and, through a direct relationship with other projections, may also be the starting point to solve further spatial problems. Axonometric representation proposed in this work is obtained by introducing projection vector p on the horizontal and vertical projection plane with axonometric projection plane π which is perpendicular to the projection vector, followed by the construction of a double transformation thus obtaining the desired image. The advantage of this procedure is the possibility of a very accurate determination of the direction of "view" of the spatial situation, which was not clear in the generally used method utilizing the axonometric axes triangle trace method.

Based on this, a new method of determining the structure of the shadows appeared. It is based on the observation that you can build an image of the spatial arrangement along with the complementary shadow if the projection vector onto an axonometric plane is consistent with the direction of the light. This requires the construction of an additional axonometric image. The image obtained includes all elements - those that are visible are illuminated, and those that are invisible are in the shadow. The transfer of their borders to other projection planes allows you to show a spatial arrangement supplemented by a shadow that makes it easier for the imagination to see a given spatial situation on all those images. Example of this method for the case where light is determined by the beam of parallel rays is presented in Fig. 2.

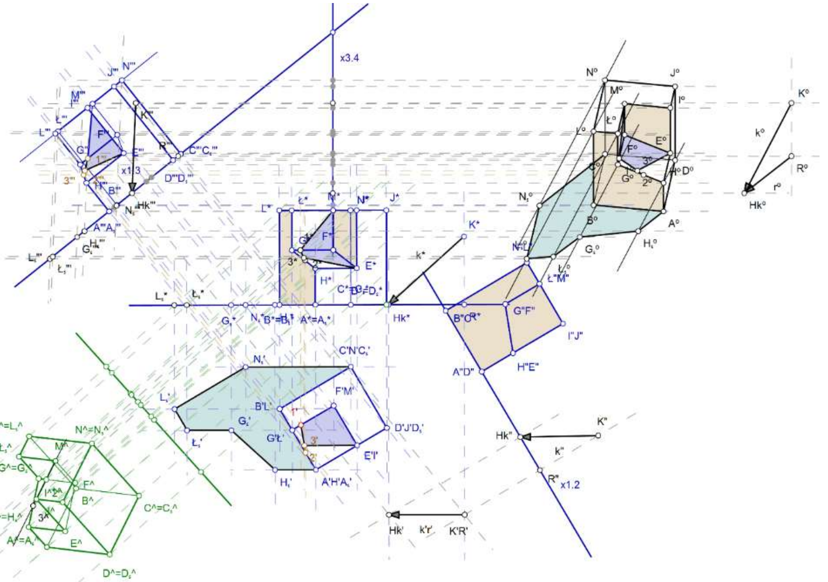

Fig. 2. Example of the use of a new described method of obtaining "axonometric" images as the basis for a new method of filling the obtained image with the shadow.

References:

[1] Łazarski M.: Zasady geometryi wykreślnej, Wydawnictwo Biblioteki Politechnicznej, Lwów, 1903.

[2] Schüssler R.: Orthogonale Axonometrie. Ein Lehrbuch zum Selbststudium, druck und verlag von B.G. Teubner, Leipzig und Berlin 1905.

[3] Pémová M., Sklenáriková Z.: Karel Pelz an Oustanding Geometer of the 19th century, w: Bečvářová, M.; Binder Ch.: Mathematics in the Austrian-Hungarian Empire. Proceedings of a Symposium held in Budapest on August 1, 2009 during the XXIII ICHST, Praha, Matfyzpress, sierpień 2010, s. 125-136.