

INTERACTIVE PRESENTATIONS OF SELECTED DESCRIPTIVE GEOMETRY PROBLEMS IN THE FLASH MX PROGRAM

Sylvia CICHACZ¹, Tomasz WIEJA²

¹ AGH University of Science and Technology Faculty of Applied Mathematics
Mickiewicza av. 30, 30-059 Kraków, Poland
e-mail:cichacz@agh.edu.pl

² AGH University of Science and Technology Faculty of Mining and Geoengineering
Mickiewicza av. 30, 30-059 Kraków, Poland
e-mail: twieja@poczta.fm

Abstract. The program Flash MX is designed to create, among other things, commercial Web sites and presentations that can clearly explain complex issues and research in all fields of science, art, and culture. This is a new platform for advanced interactive applications that can be distributed online and on CD-ROM. The paper describes the use of Flash MX for the presentations of selected constructions of descriptive geometry. Presented geometric constructions have been made in the Monge, Mapping and Central projections methods. Created computer animations are part of e-learning platform on the Internet.

Keywords: Descriptive geometry, Flash MX, animation, constructions, visualization, presentation

1 The Flash MX Program

The *Flash MX* program is created for making commercial web pages and for presentation that can help to explain some complex problems. Application of the technology rely on making animations using vector graphics with key frames rules.

The *swf* files (traditionally called *Shock Wave Flash*) can be played at a web site with internet browser, where some plug-in is installed (for example *Adobe Flash Player* platform) or in a special program. The use of an object-oriented language in *Flash*, called *ActionScript*, makes it possible to increase the interactivity of the application. *ActionScript* has event handling mode making (for example: release of mouse) and because of this, one can make animations and applets of varying degrees of interactivity and function. Applications of this kind have bigger potential because the files with vector graphic made in *Flash* program are relatively small and vector pictures are scaled. The sound and animation data can be delivered in the form of a data stream with few requirements concerning capacity of the net. Additionally, applets delivered by Flash technology is enriched by navigation elements.

Flash program lets import, copy and save bitmap files. It distinguishes many formats, it can also operate with alpha channel [1].

2 Selection of the Flash MX program for making geometric presentation

The Flash MX program was developed as a tool to create interactive animation. I was the analysis of the properties of this program that decided to choose it as an Internet platform for the presentation of selected issues of descriptive geometry. The decisive factor here was the motion animation of the Motion Tweening type consisting on the fact that we draw only those frames that contain key shots, and the Flash fills in these missing. In this way we create quite a complicated motion with little effort and more importantly the animation does not take much memory. We use the animation to the objects that are grouped. It is possible to animate

the transformations of the objects and the effects assigned to them. This option allows to easily manage the key frames adding the actionscripts in them, the time of the animation of individual objects and create parallel animations (e.g. projections). Particularly important is the ability to create simultaneous presentations mutually coordinated in time. In our case we draw separately the axonometric record and projection picture, taking care of proper time of presenting them. In addition, Flash MX allows individual control of the animations. We create the symbols of the buttons in order to allow the user to interact with the animation. Symbols – the buttons are responding to the events generated by the mouse or keyboard. Appropriate actions can be assigned to the buttons so that the animations can be controlled by the user. The buttons are an indispensable part of each interface. In addition, the *Flash* program makes it possible to demonstrate all the phases of the carried out construction, which in effect allows to understand not only the principles of the orthographic projection on two reference planes but also a simultaneous watching particular elements being introduced into the drawing, such as points, lines and planes forming final solution of the problem. The gradient fill is of a very great importance as far as the quality of the picture is concerned. It induces in the observer of the axonometric drawing, a 3D impression.

3 Geometric presentations in Flash MX

Demonstration of dimensional geometric problems in the form of the interactive presentation is one of the elements that offers facilities for understanding a given concrete spatial task. Presentations and visualizations of selected problems are of dynamic or static character. Each stage of the construction making is presented in the form of an axonometric record as a pictorial drawing as well as in the Mapping, Monge or Central projection on two reference planes. In turn, the constructions recorded in the *Flash* program create interactive computer graphics in which the elements of the axonometric drawing are mutually tied with the recording of the given geometrical problem in the Mapping, Monge or Central projection.

Animation is automatically or manually controlled and it can have an optional speed depending on the user's requirements and individual settings. Visualization consists of two diagrams interactively connected. Spatial recording of the problem has been executed in axonometry and the corresponding solution presented in the Mapping, Monge or Central projection. The axonometric drawing preserves three-dimensional character by means of properly selected pallet of colors for points, lines and planes. Co-ordination of spatial drawings with planar recordings in assumed projection method consists on concurrent construction of separate elements making the drawings. The co-ordination also comprises technical parameters being characteristic of animation i.e. speed, direction and time. Resulting from it is the possibility of simultaneous watching of particular stages of the construction being made with the use of the animation option. The animation is controlled by a set of switches which have been located between the drawings. By means of the switches the presentation can be individually controlled by the user of the software [2].

The presented selected animations in the Monge projection are realized in the so - called *trace method* currently used in the geological – mining fields at the AGH University of Science and Technology in Kraków. The presentations are available on the website <http://home.agh.edu.pl/~gwiki/geometria.php> [5]. The scope of the project web script will also include presentations in the *traceless method*. Author's ambition is to develop a complete set of presentations, including all methods of projections used in teaching descriptive geometry and engineering graphics.

Presentation 1 – the Monge method, geometrical problem – finding a real magnitude of the dihedral angle between planes α and β (Fig.1) [2].

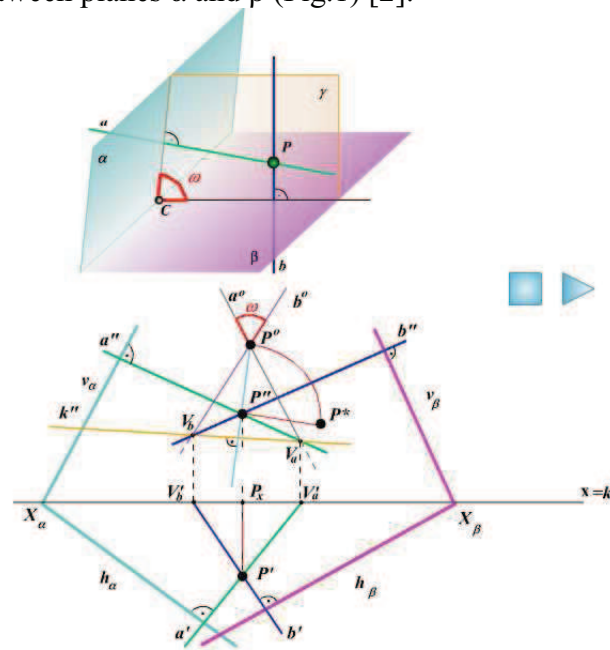


Figure 1

Presentation 2 – the Monge method, geometrical problem – finding an angle between a line and a plane (Fig. 2) [2].

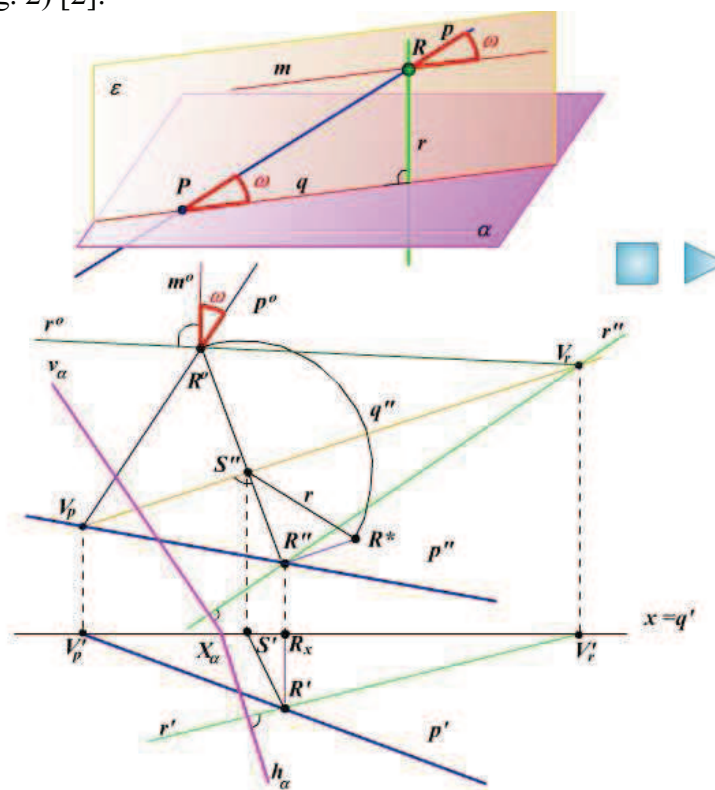


Figure 2

Presentation 3 – Central Projection. Construction of rabatment of line a in general position belonging to given plane α (Fig.3) [3].

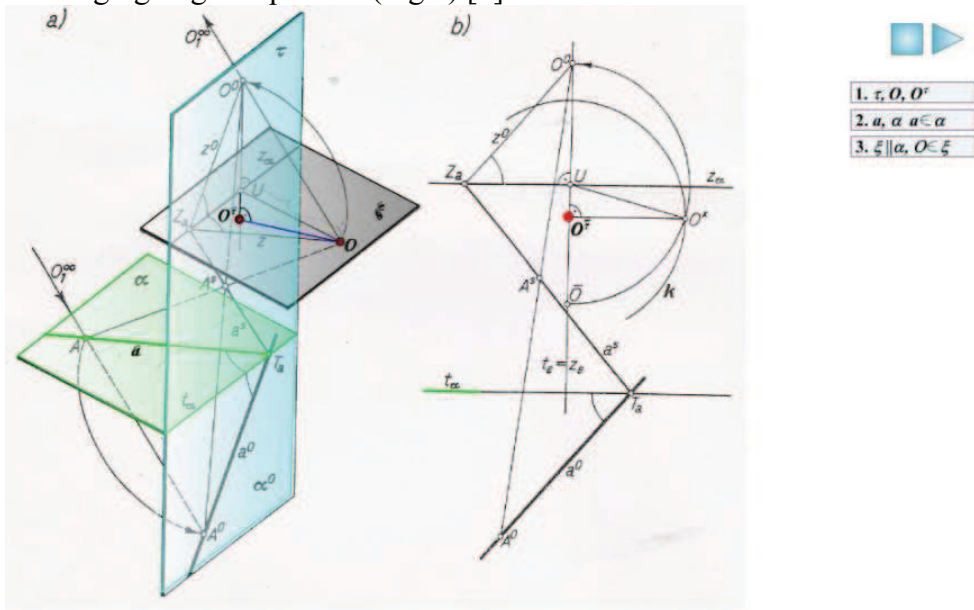


Figure 3

Presentation 4 – Central Projection. Construction of vanishing point $Z_{\alpha 90}$ of lines perpendicular to given plane (Fig. 4) [3].

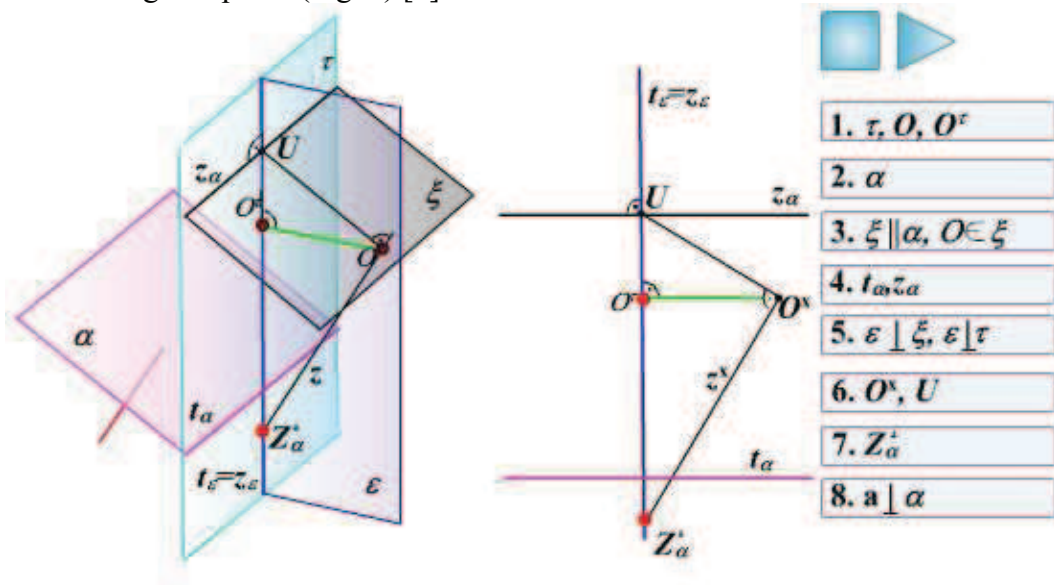


Figure 4

Presentation 5 – the Mapping Projection method. Geometrical problem – finding piercing points of pyramid by a straight line (Fig. 5) [4].

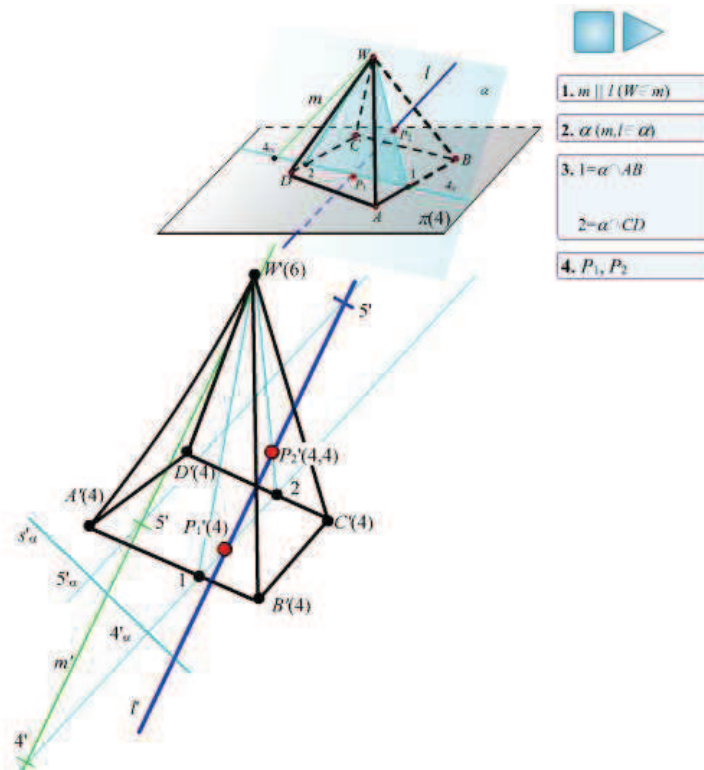


Figure 5

4 The use of web presentations in e-learning education

E-learning platform (*distance learning*) is a training technique based on the use of electronic media such as internet, intranet, extranet, satellite broadcasting, audio/video tapes, interactive TV and CD-ROM. An essential element of *distance learning* is characterized by moving the center of gravity in teaching from the teacher to the learner. The development of computer technology and availability of the Web allows for widespread use of the resources collected on the Internet. The basic advantages of the e-learning platform are as follows: saving time, any number of trainees, continuous improvement of the teaching program and the modern way of teaching. E-learning also allows for the continuation of the educational process at any time of day or week and the possibility of multiple repetition of the contents until they are fully understood. Experience in conducting classes in descriptive geometry and engineering graphics supports the conclusion that the students during the teaching process are looking for solutions to problems of geometry on the Internet. Thus, the development of visualization and animation of selected geometric topics enriches the teaching by interactive educational system.

Application of Flash MX to develop geometric presentations allows them to be placed on the websites and use online. In the case of teaching descriptive geometry this system can only be a complementary element to the traditional methods of education. It should assist in understanding selected issues of the spatial geometry. For the essence of teaching descriptive geometry is the formation of spatial imagination (*mental sphere*) and graphic recording of constructions (*manual sphere*). The classes are of design character. Proper control of the student's work is possible only in an interactive contact with the teacher.

5 Conclusions

Using modern computer technology in teaching descriptive geometry is part of expanding educational offerings. Flash MX allows for the implementation of computer animation of selected geometric issues, and also makes it possible to put the animation on the Internet. The effect of this is the opportunity to build e-learning platform that is available to the students in an unlimited time. It complements the traditional forms of education. An interactive animation allows you to control any various stages of construction and phasing step by step algorithm for resolving the issue. It also makes it possible to work independently and understand the problems existing in different geometric projections.

References

- [1] http://pl.wikipedia.org/wiki/Adobe_Flash
- [2] Cichacz S., Sulima-Samujllo T., Wieja T.: *Application of the Flash MX program to visualization of selected metric problems*. Proceedings of Symposium on Computational Geometry SCG'2005 Kocovce September 2005, Bratislava 2005, 21-25.
- [3] Cichacz S., Wieja T.: *Computer Aided Teaching of Central Projection in the Flash MX Program*. Proceedings of Symposium on Computational Geometry SCG'2007 Kocovce September 2007, Bratislava 2007, 23-27.
- [4] Cichacz S., Wieja T.: *Assessment of the properties of the Flash MX program in presentation of solid geometry problems*. Geometry and Computer Graphics 2007 Sbornik 27. konference o geometrii a poctacov grafice, Nedvedice, Jihoceska Univerzita v Ceskych Budejovivich, 37-44.
- [5] <http://home.agh.edu.pl/~gwiki/geometria.php>

INTERAKTYWNE PREZENTACJE WYBRANYCH ZAGADNIEŃ Z GEOMETRII WYKREŚLNEJ W PROGRAMIE FLASH MX

Program Flash MX przeznaczony jest do tworzenia m.in. komercyjnych stron WWW oraz prezentacji, które w przejrzysty sposób mogą wyjaśnić złożone zagadnienia i wyniki badań we wszystkich dziedzinach nauki, kultury i sztuki. Jest to nowa platforma dla zaawansowanych interaktywnych aplikacji, które mogą być rozpowszechniane w Internecie, jak i na płytach CD-ROM. W artykule przedstawiono zastosowanie programu Flash MX do prezentacji wybranych konstrukcji z geometrii wykreślnej. Prezentowane konstrukcje geometryczne wykonano w rzutach Monge'a, Cechowanym i Środkowym. Utworzone animacje komputerowe są elementem platformy e-learningowej dostępnej w Internecie.