

COMPUTER AND THE SPATIAL IMAGINATION IN GEOMETRY

Currently the incoming students of our university - VŠB – TU of Ostrava – are graduates of various types of schools – grammar schools, technical colleges and training institutions. The standards of these schools are quite different and, therefore, the level of knowledge of students in mathematics and geometry also varies. The students have, however, one thing in common – a very low level of development of spatial imagination. This is due to an absolute absence of teaching of descriptive geometry at most schools and there is also only a minimum of attention devoted to stereometry in the subject of mathematics. The development of spatial imagination, so much needed in our students – future technical engineers, is, hence, neglected.

The university, therefore, carries the main burden of the development of spatial imagination of future engineers. The students encounter the subject of descriptive geometry already in the first semester. It causes them, due to the above mentioned reasons, significant problems. It is then a task for the teacher to help his/her students, using all means available, develop their spatial imagination.

Without any doubt, one of the tools very actively used in this process is computer. It is not there to substitute for a teacher in the teaching process, but with the help of computer, a teacher can demonstrate a large number of alternatives and ways to examine a particular problem. This system brings more work for the teacher, but also more interest in geometry from the students. At IMDG VSB-TU we elaborated some spatial problems on solids for the computer – in particular intersections of solids with a plane, intersections of line and a solid and some other intersections of solids. It was our goal to depict the examples in such a way that they would be graphic and clear, would respect the methodological approach to the solution and would show all the spatial relations between the geometrical objects. The examples are processed on “Modelar” software.

An intersection of the cylinder of the rotation with a plane may serve as an example. The task is, for the sake of clarity, solved in axonometry. The individual steps of the solution are depicted on the screen in the following order:

- 1. Representation of the solid:**
cylinder of the rotation is depicted.
- 2. Representation of the intersection plane:**
mutual positions of the cylinder and the section plane are depicted (see Fig. 1).
- 3. Construction of the centre of the intersection ellipse and of one of its diameters:**
an auxiliary plane and its intersection with the section plane is depicted, together with the centre of the intersection ellipse and also one of its diameters.

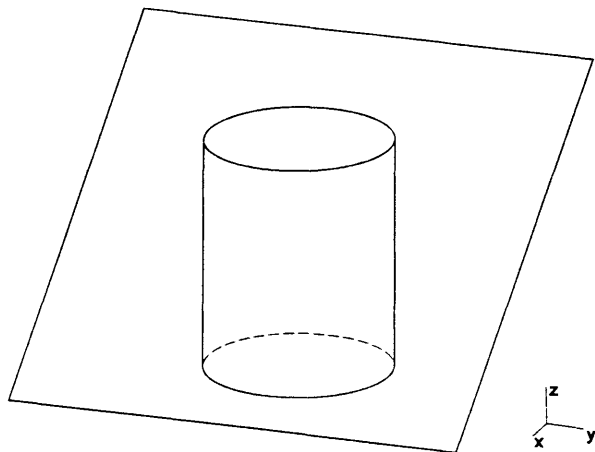


Fig. 1

4. Construction of the second conjugated diameter:

the plan of the diameter of the ellipse and a corresponding diameter of the intersection ellipse is depicted (see Fig. 2).

5. Construction of the tangent points:

using affinity to construct the points at which the intersection ellipse is tangent to the outline of the cylinder.

6. Representation of the section:

the cut-off part of the cylinder is depicted including all the spatial relations (see Fig.3).

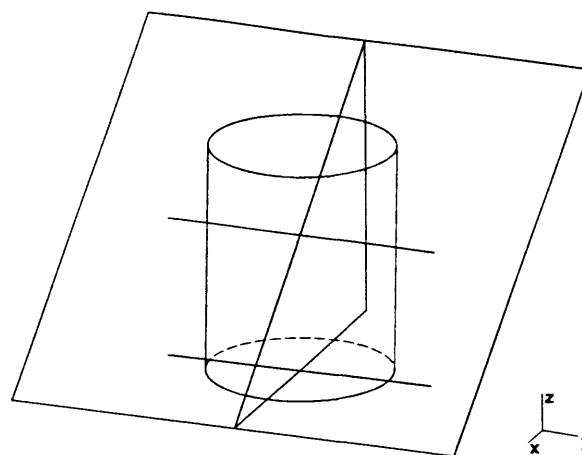


Fig. 2

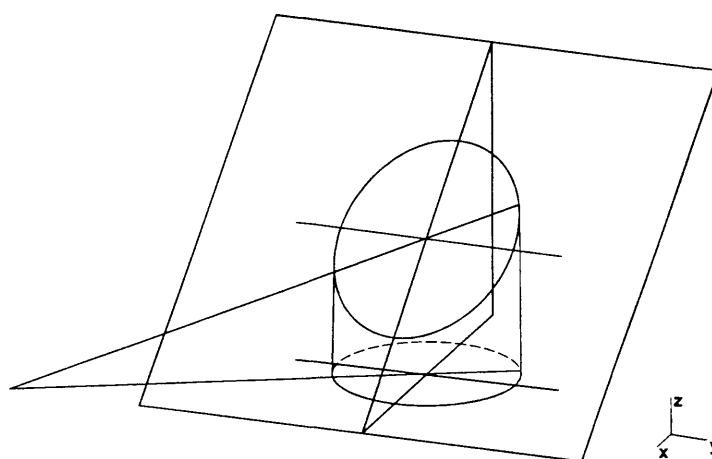


Fig. 3

7. Rotation:

the whole picture including the depicted affine relations rotates around z axis, ten positions are depicted.

The example can be stopped and restarted at any point. This allows for the teacher to make comments on the picture depicted on the screen. The only disadvantage of "Modelar" stems from its ability to work only with solids; it cannot depict a line, a point or a plane.

The greatest contribution of these programs is not just in the methodical approach to a problem but particularly in rotation of the solid and of the section plane which shows spaces relations to students.

KOMPUTER I WYOBRAŻNIA PRZESTRZENNA W GEOMETRII

Autor omawia opracowany w VŠB-TU Ostrava program komputerowy "Modelar" wspomagający nauczanie geometrii wykreślnej.

Program zajmuje się w szczególności przekrojami brył (ostrosłupy, graniastosłupy stożki i walce) oraz punktami ich przebicia. Twórcy programu widzą zasadniczą jego rolę nie w podejściu metodycznym ale w możliwych do pokazania obrotach brył (wraz z elementami tnącymi), ułatwiających studentom obserwowanie zachodzących relacji przestrzennych.