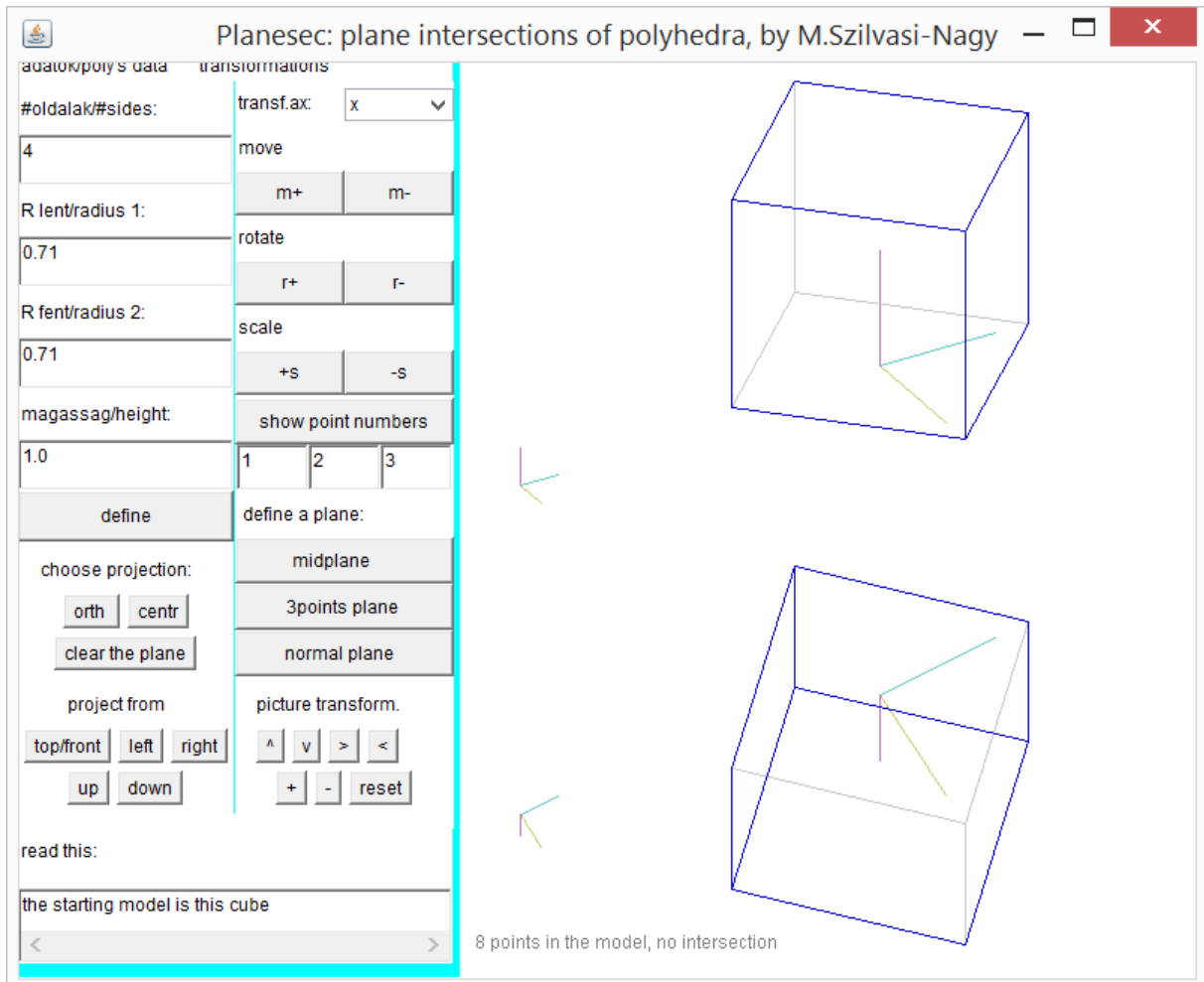**Planesec:** a program for definition and spatial transformations of a regular truncated pyramid, and for computation of the line of intersection with a plane.

The window of the program may appear in icon-size. In this case enlarge the window!

Use the menu system! The mouse is not active in the drawing field!

The polyhedron is a regular truncated pyramid defined by the number n of side faces, the radius R_1 of the circumscribed circle of the base polygon, the radius R_2 of the circumscribed circle of the covering face and the hight m (h). With the special data at starting the program the polyhedron is the unit cube. It is shown in the Monge projection by two orthogonal projections. You may change the polyhedron by entering appropriate data in the textfields on the left side of the menu. The vertices and two points on the axis of simmetry are numerated (*show point numbers*).
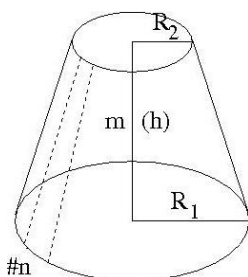
The central projection (click on the button *centr*) shows an anaglyph picture, which makes a 3D effect by using red-green glasses.

The spatial transformations are

moving the model along a coordinate axis in positive or negative direction by the buttons *m+* and *m-*,

rotating the model around a coordinate axis or an axis defined by two numbered points in the positive or negative direction by the buttons *r+* and *r-*,

scaling (stretching or shrinking) the model in the direction of a coordinate axis by clicking on the buttons *+s* or *–s*, where the scale factor is constant (1.1 or 0.9, respectively).

The **axis** of the transformations should be defined from the textfield *transf.ax* before starting the transformation.

The **plane** of intersection is defined by three points, the numbers of which are shown in the textfields on the right side of the menu. A triangle in the plane is shown for visualizing it. The position of the plane remains fix while transforming the polyhedron. In this way the mutual position of the polyhedron to the plane is changing, consequently also the line of intersection.

midplane is defined by the two numerated points on the symmetry axis and the vertex number 1,

3points plane is defined by three points, the numbers of which are in the textfields above "define a plane",

normal plane is perpendicular to the segment defined by the first two point numbers and passes through the point specified by the number in the third textfield.

If the defined plane does not intersect the polyhedron, then move or rotate the polyhedron!

At starting the program the point numbers are 1, 2 and 3. The command *3ponts plane* define the base of the model, and there is no line of intersection. In this case just move the model along the axis *z* by clicking on *m-* (or ratate it). The command *normal plane* defines the face 2-3-7-6 of the cube, which is perpendicular to the edge 1-2 and passes through the vertex 3, and there is no line of intersection. In this case move the model along the axis *x* by clicking on *m-* (or rotate it).

Examples

1. Line of intersection with a plane of symmetry.

Click on the button *midplane*!

You may change the direction of projection by clicking on the buttons *top/front, left, right, up* and *down* on the left side of the menu.

By choosing the projection *ort* the Monge projection (two orthogonal projections) will be shown without the point numbers. *top/front* shows the orthogonal views on the coordinate planes.
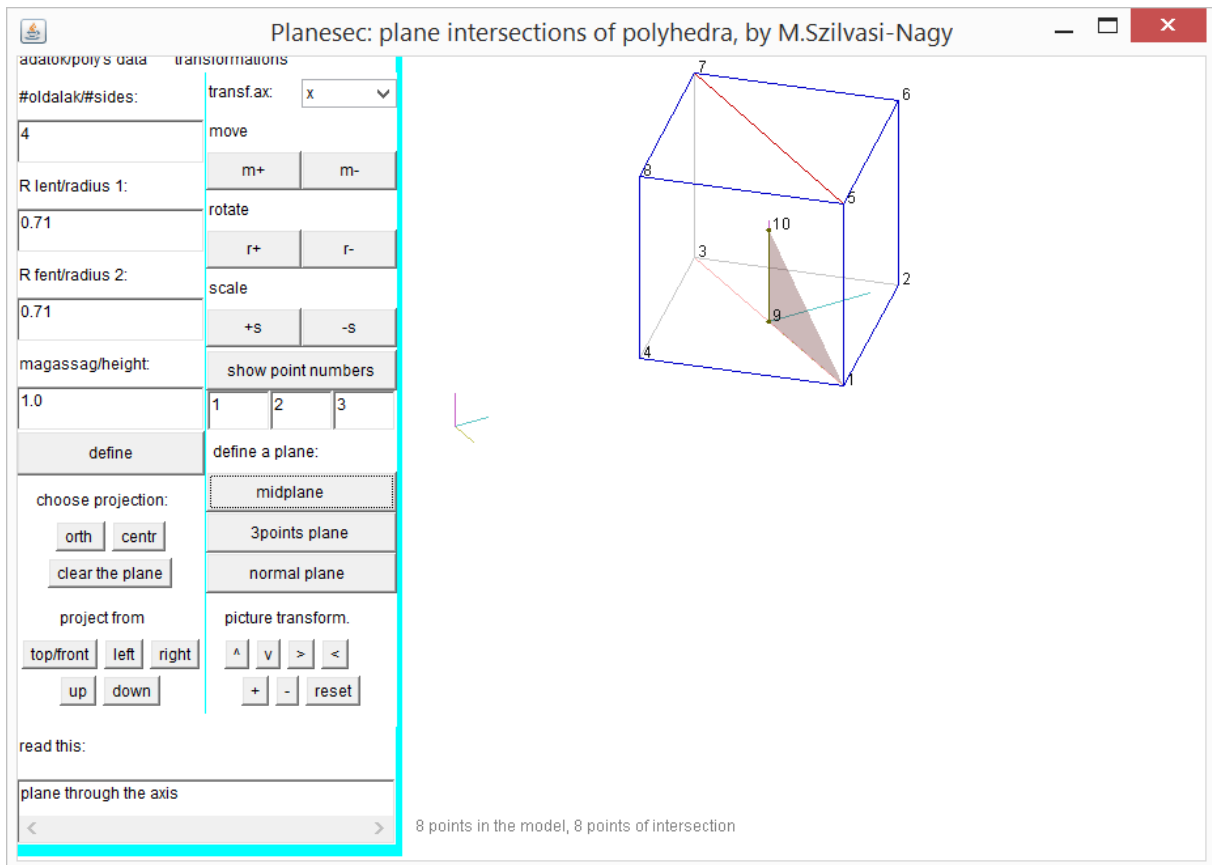
2. Definition of a polyhedron approximating a cone and generating cone sections (hyperbola, ellipse)

Enter the following data in the textfields: #n = 18, radius 2 = 0, click on *define,* then *show point numbers*! Enter the point numbers 3, 17, 19, then click on *3points plane*! A parallel plane to this one intersects this „cone" in a hyperbola. Move the model along the axis *x* by clicking on *m+* several times, you'll get different **hyperbola**s.

Watch this line of intersection from different directions by using the commands of *project from*. Change into the Monge projection by *orth* and *top/front*, or choose central projection by *centr* (you need red-green glasses). You can still move the „cone" for generating different lines of intersection.

In the figure picture transformations have been made: „+" enlarges the projection, „<" and „V" move it in the screen.

An **ellipse** arises by rotating the „cone" around the axis *y*: choose for transf.ax. y, then rotate by *r+* three times!

adatok/poly's data   transformations

#oldalak/#sides:

18

R lent/radius 1:

0.71

R fent/radius 2:

0.0

magassag/height:

1.0

define

choose projection:

orth   centr

clear the plane

project from

top/front   left   right

up   down

read this:

moving downwards by 80 pixels

transf.ax: x

move

m+   m-

rotate

r+   r-

scale

+s   -s

show point numbers

3   17   19

define a plane:

midplane

3points plane

normal plane

picture transform.

^   v   >   <

+   -   reset

19 points in the model, 13 points of intersection

adatok/poly's data   transformations

#oldalak/#sides:

18

R lent/radius 1:

0.71

R fent/radius 2:

0.0

magassag/height:

1.0

define

choose projection:

orth   centr

clear the plane

project from

top/front   left   right

up   down

read this:

rotating the model by +pi/12 around the specified axi

transf.ax: y

move

m+   m-

rotate

r+   r-

scale

+s   -s

show point numbers

3   17   19

define a plane:

midplane

3points plane

normal plane

picture transform.

^   v   >   <

+   -   reset

19 points in the model, 18 points of intersection

Create new examples and have a lot of fun!

M. Szilvási-Nagy