Cylinder intersections with the program Stella 4D

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With the software Stella 4D (author: R. Webb) you can easily display cylinder intersections.

1. Introduction

The program Stella4D was written for the display and handling of polyhedra. You can choose hundreds of polyhedra from a library and with only a few mouse clicks you can construct an unlimited number of polyhedra, analyse and handle them in manifold ways. Since by definition polyhedra are bounded by planar faces, the program cannot display real cylinders. So for the present work many-sided prisms were used. These can be obtained by entering the data set of the desired prism into the according box e.g. 480,4,4 (picture 1).

480-fold prism

picture1

2. Intersection

The „intersection“ of the „cylinders“ is done by putting these on the faces of polyhedra (=”target polyhedron“). After that you create the inner core. Picture 2 shows the space being obtained by two congruent cylinders, if these intersect at an angle of 90 degrees. This figure is available very easily: First you choose the cube from the library and you select one face. Then you activate the button „put models on faces“, by which polyhedra from the library or such ones you put into the memory before, can be sited on a face of the target polyhedron. Depending from the ratio of the height of the cylinder and the edge length of the cube, you choose a suited depth (e.g. 120%). This procedure is repeated with a second face perpendicular to the first one. Now you give it a colour system showing all components in different colours, and you remove the cube. Afterwards you create the convex core by pressing the button in the “poly”-menu.

2 prisms, 90°

picture 2

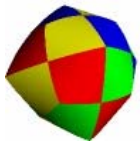
3. Advancement

Depending from the symmetry of the target polyhedron, you can get a lot of interesting figures in this way. Pictures 3 und 4 exemplify the procedure by four cylinders embedded into an octahedron.

octahedron with 4 prisms

picture 3

Stella also allows to put cylinders onto the vertices of polyhedra, producing structures based on the symmetries of the polyhedra dual to former ones. You can put cylinders on all faces or vertices at the same time or on those belonging to a set of congruent faces.



4 prisms, core

picture 4

For the generation of the core, it isn’t nessessary that the facelets of the intersecting prisms which finally form the core, are really present in the inner space of the target polyhedron. In fact it is sufficient to put the prisms on the faces or vertices (depth 0 %) and to create the core, even without removing the target polyhedron. But for a better view you should not forget to colour the arrangement as a compound.

4. Problems

Sometimes, for reasons of symmetry, you get stripes of different colours where there should be only one, when creating the core. But this can easily be adjusted afterwards by the comfortable colouring options of the program.

When positioning the prisms on the faces of the target polyhedron, the program arbitrarily chooses an orientation of the prisms depending from the rotation symmetry of the target face and the user can't control it. This can have unwanted effects.

On closer examination, you see that in figures derived from bodies without spherical symmetry like many Johnson polyhedra, the rotaion axes of the cylinders do not intersect in only one point. The reason for this may be the fact that the axes are orientated towards the inversion centres of different sets of faces of the target polyhedron. Nevertheless, these models provide an aesthetical attraction, see http://www.polyedergarten.de/johnson/index.html

Reference: http://www.software3d.com/Stella.php

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