An Interactive Polyhedral Computer Model

Will Hawkins and Robert McDermott
Center for High Performance Computing

An Interactive computer model has been programmed in C++ with OpenGL and runs on a Windows PC. The model has a fundamental region with three face planes and three symmetry planes combining to form a closed 3-dimensional region. A mouse can be used to zoom in and out, rotate incrementally or rotate continuously to see all sides of the fundamental region. Keyboard input can be used for integer values for three different polyhedral symmetry families of tetrahedra, octahedra, and icosahedra polyhedra. Keyboard input can also be used to vary the 3 coordinate values of a control point moving around a unit cube. As these values vary between 0 and 1, the faces of the fundamental region respond by changing their shape.

When the fundamental region is combined with transformations a closed polyhedron is displayed. The user can choose to display the polyhedron with alternate tints for the fundamental region faces. This gives the user a coloration queue that clearly displays how the polyhedron is composed of many different faces derived from the fundamental region. Alternatively the user can choose to display the polyhedron with only three colors. When the full polyhedron is being displayed both the symmetry numbers and the coordinate point coordinate values can be observed as well as changed for the displayed polyhedron to change shape.

The display can exhibit both the Platonic and Archimedean Polyhedra as well as displaying smooth change of shape between these well known polyhedra. A laptop computer and a projector will be available for the Research Posters on the Hill event to allow legislators to interact with this software and view the result of changing of values being directly connected to a change in the shape of a polyhedron.

Currently work is being done to extend the continuous 3 plane fundamental region to a continuous 10 plane fundamental region. If this result is available it will be shown to legislators.

Will Hawkins is supported by funding from The University of Utah, Undergraduate Research Opportunities Program.