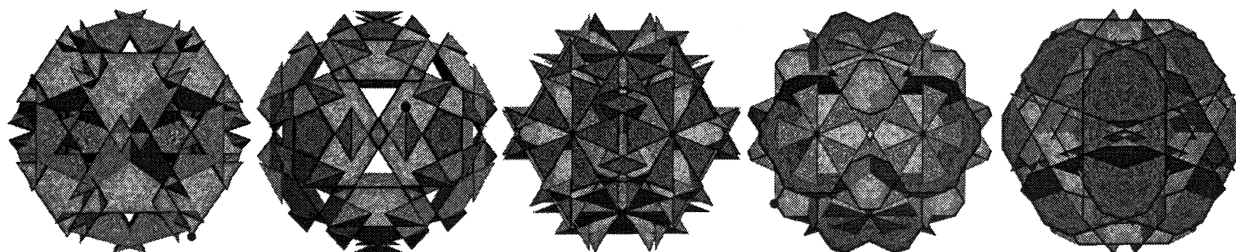


## About Enumeration of Isogonal Polyhedral Families

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*Isogonal* polyhedron is a polyhedron whose vertices are transitive under transformation of polyhedron's symmetry group. The well-known 76 uniform polyhedra are isogonal polyhedra with additional restriction - polyhedral faces may be only regular polygons. Isogonal polyhedra are much more numerous and in fact usually they form a continuous families of topologically equivalent shapes. To date there were few systematic attempts to classify or enumerate all such families. Gruenbaum in [1] gives a description of several new classes of isogonal prisms. Author in [2] gives a partial enumeration of special subclass *kaleidoscopic* isogonal polyhedra. Our current attempt is to enumerate general isogonal families of polyhedra. The author wrote a computer program, which searches for all possible ways to compose isogonal polyhedron with given symmetry. All polyhedra found are separated into topologically equivalent sets or families. The following algorithm is used. For given polyhedral symmetry some generic arbitrary location of first vertex on a unit sphere is chosen. Symmetry transformations applied to first vertex make all the vertices of polyhedron. All possible planes passing through first vertex and at least two others vertices are calculated. All possible polygons in every such plane are calculated. These polygons are candidates to be a polyhedron faces. After that the program tries to make complete chain of faces around first vertex. The adjacent faces in the chain should share exactly one edge. Due to processing power limitation only chains no longer then some fixed length are considered. Different location of the first vertex will generally lead to different polyhedron. However all such polyhedra with different first vertex location but with identical way to form faces will form one isogonal family. There is continuous transition between all polyhedra in one family. So far many thousands of new isogonal polyhedral families were found. Interactive VRML models of these families are made. Five representatives of one isogonal polyhedral family with full icosahedral symmetry  $I_h$  are illustrated. The ongoing task is to study these sets and to find appropriate classification.



### References.

- [1] B.Gruenbaum, Isogonal Prisms. *Discrete Comput. Geom.* **18**, 13-52, 1997.
- [2] V.Bulatov Kaleidoscopic Polyhedra Families. *Proceedings of Millennial Open Symposium on the Arts and Interdisciplinary Computing "Mosaic 2000"*, p.103-113 (Seattle, USA).  
<http://www.physics.orst.edu/~bulatov/polyhedra/mosaic2000/talk/index.html>