On the automorphism group of cubic polyhedra

Maryam Jalali-Rad
Department of Pure Mathematics, Faculty of Mathematical Sciences,
University of Kashan, Kashan, I. R. Iran
jalali6834@srttu.edu

Modjtaba Ghorbani
Department of Mathematics, Shahid Rajaee Teacher Training University, Tehran, I. R. Iran
mghorbani@srttu.edu

By using method of graph theory, we can construct cubic graphs whose faces are squares, pentagons and hexagons. We call sometimes these graphs as fullerene graphs, see [1, 2]. In general, a fullerene, is a cubic three connected graph whose faces entirely composed of triangles, squares, pentagones and hexagons. There are many problems concerning with fullerene graphs and many properties of them are studied by mathematician. Given a triple $t = (p_3, p_4, p_5)$, we denote by p_t the class of 3-valent polyhedral graph having p_3 triangular, p_4 quadrilateral, p_5 pentagonal and h hexagonal faces, and no other faces. The number of vertices of a polyhedron belonging to the class p_t is $n = 2p_3+2p_4+2p_5+2h-4$. In chemical applications it is often important to make the distinction between the symmetry of the polyhedron as a combinatorial object and the physical symmetry of its realization as an affine object in $3D$ space.

In general, a (4,5,6) - polyhedron is a cubic planar graph whose faces are squares, pentagons and hexagons. A (3,5,6) - polyhedron is a cubic planar graph whose faces are triangles, pentagons and hexagons. In this paper, by using the methods of [3], we compute the symmetry group of both (3,5,6) and (4,5,6) polyhedrons.

References

[1] H. W. Kroto, J. R. Heath, S. C. O'Brien, R. F. Curl, R. E. Smalley, *Nature* **318** (1985) 162.

[2] H. W. Kroto, J. E. Fichier, D. E. Cox, *The Fulerene*, Pergamon Press, New York, 1993.

[3] K. Kutnar, D. Maručić, D. Janezic, Fullerenes via their automorphism groups. *MATCH Commun. Math. Comput. Chem.* **63** (2010) 267–282.