Extension of Fundamental Transversals and Euler's Polyhedron Theorem.

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In 1752 Euler discovered that the number of vertices minus the number of edges plus the number of faces of a convex polyhedron is always equal to 2. This is known as Euler's Polyhedral Formula, or sometimes Euler's Polyhedron Formula. Polyhedra plays an important aspect in many fields of Mathematics, especially in Geometry. During the birth of group theory, symmetry manufactured most of the development of symmetry groups, permutation groups, and automorphism groups of Polyhedra. The concept of an orbit of an element of a polyhedron further developed into the creation of what is called a fundamental transversal. A *fundamental transversal* of a polyhedron intersects each element and induces a connected sub graph of the polyhedron. Meaning that each element that is intersected is a representative of the orbit that they belong to. We are interested in investigating the number of orbits that a fundamental transversal has on a given polyhedron. In this talk we will present a new extension of Euler's polyhedron formula to provide different classifications of Polyhedra according to their Euler orbit characteristics. An *Euler Orbit Characteristic* (EOC) is the number of orbits of vertices (#Vg) minus the number of orbits of edges (#Eg) plus the number of orbits of faces (#Fg) of a polyhedron. We will provide three different cases of an EOC to show its usefulness in cataloging various types of Polyhedra. Recently, we have found that an EOC could be useful and applied to further description and tabulation of certain Capsids. Since Capsids are in the majority of either helical or icosahedral structure – then applying our extension theorem could possibly help create a limpid view of the various virus we encounter.

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