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Computational Method for Identifying Space Polygons

As computer modeling often suffers from small errors, it can often be difficult to tell when computed polygons are one and the same. That problem becomes even harder as they are allowed to rotate in three-space. The focus of this poster is to describe and give examples of one method for overcoming these issues.

By utilizing the fact that the space of closed n-edge space polygons of fixed length 2 can be described as a projection from the space of orthogonal pairs of complex unit vectors in n-space, and embedding this construction in a natural projection from a sphere in quaternionic n-space, we are able to give it a metric arising from that of the Stiefel manifold $V_2(\mathbf{C}^n)$. Additionally, we can track polygons along the projected geodesics, to provide a visualization of a path one polygon must take to reach another. Moreover, all computations involved can be done quickly and efficiently, and allow for easy direct sampling of n-edged polygons according to this metric in $O(n)$ time.