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Beyond Curves and Shapes of Constant Width

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Abstract of Report Talk:
Our project uses geometric concepts to explore the properties of strictly convex curves and shapes of constant width. That is, regardless of how they are turned, they fit in-between two parallel lines or planes separated by the width w of the object. The most trivial examples are the circle and the sphere. However, there exist many other constant width curves in $\mathbb{R}^2$ (and surfaces in $\mathbb{R}^3$) such as Reuleaux polygons and the motor of the Wankel engine. Given that these curves and surfaces are strictly convex, we utilized a support function and its Fourier series to describe the movement of a supporting line $S(\theta)$ around the curve (or surface). We looked at how convex figures can be inscribed in convex polygons such as a triangle whose angles are rational multiples of a right angle, so that they touch all sides, no matter the orientation of C (a property called equi-inscribability). We find (in the $\mathbb{R}^2$ case) the range(s) for the external angles of any n-gon (where $n \geq 3$) and the corresponding symmetries of the curves of constant width that can be equi-inscribed in them.

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