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Polysurfacic Tori or Kideas Inspired by the Möbius Strip Topology

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Abstract

Polysurfacic tori or kideas are three-dimensional objects formed by rotating a regular polygon around a central axis. These toric shapes are referred to as "polysurfacic" because their characteristics, such as the number of sides or surfaces separated by edges, can vary in a non-trivial manner depending on the degree of twisting during the revolution. We use the term "Kideas" to specifically denote these polysurfacic tori, and we represent the number of sides (referred to as "facets") of the original polygon followed by a point, while the number of facets from which the torus is twisted during its revolution is indicated. We then explore the use of concave regular polygons to generate Kideas. We finally give acceleration for the algorithm for calculating the set of prime numbers.

Keywords

Heavenly Things, Topology, Euclidian Geometry, Möbius Strip, Emmanuel's Tori, YiBoLong's Tori, Cadier's Tori, Möbius Tori, Polysurfacic Tori, Kideas, The Keys, KideaCross, KideaStar, Churros, Algorithm for Calculating the Set of Prime Numbers $\mathbb{P}$, The Last Found Element of $\mathbb{P}$

1. Introduction

Polysurfacic tori or kideas are the solids generated by the circular revolution of a regular polygon [1]. We call these toric shapes "polysurfacic" because, depending on its torsion on its revolution of zero, one or more "facets", its number of side(s), or surface(s) separated by an edge overall will vary from non-trivial way.

We call these polysurfacic tori Kideas, and we make follow the number of sides of the generation polygon (called "facets") by a point and the number of facet(s) from which the torus is twisted on his revolution.

The direction of twisting doesn't matter for the number of surface(s) as long as we keep twisting on that direction, but it can mean on the chirality of the object (it means that two different kideas could then be equivalent).

2. Description of Polysurfacic Tori or Kideas

So the Kidea 2.0 is going from the section of cylinder to the strip in circle and all the shapes in between, taken in any proportion; and Kidea 2.1 is the Möbius strip [2], which is, as we know, globally only one side.

Kidea 3.2 is described in the drawing **Figure 1**, and Kidea 3.1 is the one that is less twisted in one facet. These two Kideas have only one side. The Kidea 3.0 and 3.3 have three sides, like the Kidea 3.6 and 3.9.

Kidea 4.0 and Kidea 4.4 have 4 sides (**Figure 2**). Kideas 4.1 and 4.3 are only one-sided (**Figure 3** and **Figure 4**). The Kidea 4.2 (**Figure 5**) has, as we notice, 2 sides. This can be seen by numbering the facets from 0 to 3. Thus facet n˚ 0 joins facet n˚ 2 during the first revolution, which joins facet n˚ 0 from the second revolution. Facet n˚ 1 will never be joined by facet n˚ 0, whatever the number of revolutions; one says that facet n˚ 1 is on another "side" than facet n˚ 0. This obviously does not depend on the numbering, and we prefer to number from 0 to 3 because this simplifies the counting of "sides" or different surfaces.

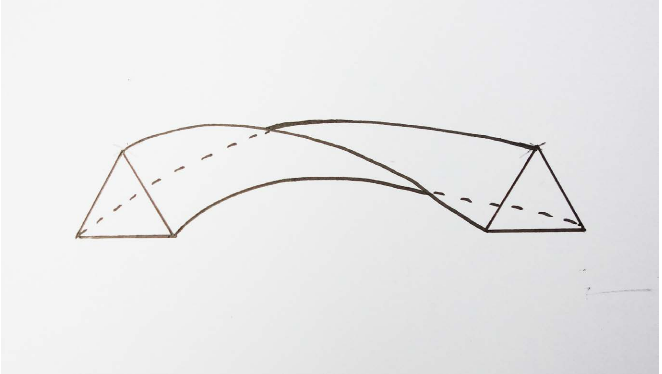

Figure 1. View in diametrical section of the Kidea 3.2.

Figure 2. Kidea 4.0.

Figure 3. Kidea 4.1.

Figure 4. Kidea 4.3.

Figure 5. Kidea 4.2.

We say 0 on 2 on 0

And the 1 on 3 on 1 either globally 2 sides.

Kideas 5.0 and 5.5 have 5 sides. And Kideas 5.1, 5.2, 5.3 and 5.4 have only one side; and each time we join facet n˚ 0, from facet n˚ 0, in 5 revolutions.

Kideas 6.0 and 6.6 have 6 sides. Kideas 6.1 and 6.5 have only one side; and we reach facet n˚ 0 in 6 revolutions.

For the Kidea 6.2 we say: the 0 on 2 on 4 on 0

And the 1 on 3 on 5 on 1 All the facets are reached in 2 surfaces; Kidea 6.2 has 2 sides.

The Kidea 6.3: The 0 on 3 on 0

The 1 on 4 on 1

The 2 on 5 on 2 Either Kidea 6.3 has 3 sides.

The Kidea 6.4: The 0 on 4 on 2 on 0

The 1 on 5 on 3 on 1 Either Kidea 6.4 has 2 sides.

One notices here that the result is symmetrical with Kidea 6.3 for middle.

Let $\mathbb{P}$ be the set of prime numbers, if *p* belongs to $\mathbb{P}$ we have, with *n* belongs to $\mathbb{N}$, $n \neq 0$, $n \neq p$ et $n \neq \alpha * p$ with $\alpha \in \mathbb{N}$:

Kidea *p.n* has 1 side

And for any *n*:

Kidea *n*.0 has *n* sides as well as Kidea *n.n* and Kidea *n.αn*; we call those Kideas, canonical Kideas of *n*.

Thus the Kideas 7.1, 7.2, 7.3, 7.4, 7.5 and 7.6 have only one side, and the canonical Kideas of 7 have 7 sides.

Kidea 8.1 has 1 side and we reach facet n˚ 0 in 8 revolutions.

The Kidea 8.2: The 0 on 2 on 4 on 6 on 0

The 1 on 3 on 5 on 7 on 1 Either Kidea 8.2 has 2 sides.

The Kidea 8.3 has 1 side and we reach the facet n˚ 0 in 8 revolutions.

The Kidea 8.4: The 0 on 4 on 0

The 1 on 5 on 1

The 2 on 6 on 2

The 3 on 7 on 3 Either Kidea 8.4 has 4 sides.

The Kidea 8.5 has 1 side and we reach the facet n˚ 0 in 8 revolutions.

The Kidea 8.6: The 0 on 6 on 4 on 2 on 0

The 1 on 7 on 5 on 3 on 1 Either Kidea 8.6 has 2 sides.

The Kidea 8.7 has 1 side and we join the facet n˚ 0 in 8 revolutions.

We notice that the result is symmetrical with Kidea 8.4 for middle.

The Kidea 9.1 has 1 side and we join the facet n˚ 0 in 9 revolutions.

The Kidea 9.2 has 1 side and we join the facet n˚ 0 in 9 revolutions.

The Kidea 9.3: The 0 on 3 on 6 on 0

The 1 on 4 on 7 on 1

The 2 on 5 on 8 on 2 Either Kidea 9.3 has 3 sides.

The Kidea 9.4 has 1 side and we join the facet n˚ 0 in 9 revolutions.

The Kidea 9.5 has 1 side and we join the facet n˚ 0 in 9 revolutions.

The Kidea 9.6: The 0 on 6 on 3 on 0

The 1 on 7 on 4 on 1

The 2 on 8 on 5 on 2 Either Kidea 9.6 has 3 sides.

The Kidea 9.7 has 1 side and we join the facet n˚ 0 in 9 revolutions.

The Kidea 9.8 has 1 face and we reach the facet n˚ 0 in 9 revolutions.

We notice that the result is symmetrical with Kideas 9.4 and 9.5 for middle.

We use here the base A (ten) = 10. A by convention without specifying the base.

The Kidea 10.1 has 1 side and we reach facet n˚ 0 in ten revolutions.

The Kidea 10.2: The 0 on 2 on 4 on 6 on 8 on 0

The 1 on 3 on 5 on 7 on 9 on 1

Either Kidea 10.2 has 2 sides.

The Kidea 10.3 has 1 side and we reach facet n˚ 0 in ten revolutions.

The Kidea 10.4: The 0 on 4 on 8 on 2 on 6 on 0

The 1 on 5 on 9 on 3 on 7 on 1

Either Kidea 10.4 has 2 sides.

The Kidea 10.5: The 0 on 5 on 0

The 1 on 6 on 1

The 2 on 7 on 2

The 3 on 8 on 3

The 4 on 9 on 4

Either Kidea 10.5 has 5 sides.

The Kidea 10.6: The 0 on 6 on 2 on 8 on 4 on 0

The 1 on 7 on 3 on 9 on 5 on 1

Either Kidea 10.6 has 2 sides.

The Kidea 10.7 has 1 side and we reach facet n˚ 0 in ten revolutions.

The Kidea 10.8: The 0 on 8 on 6 on 4 on 2 on 0

The 1 on 9 on 7 on 5 on 3 on 1

Either Kidea 10.8 has 2 sides.

The Kidea 10.9 has 1 side and we reach facet n˚ 0 in ten revolutions.

We notice that the result is symmetrical with Kidea 10.5 for middle.

11.A (eleven) is a prime number so the Kideas 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 11.7, 11.8, 11.9 and 11.10 (or B.A in hexadecimal notation) have 1 faces and we join facet n˚ 0 in eleven revolutions, and the canonical Kideas of 11 have 11 sides.

The Kidea 12.1 has 1 side and we reach facet n˚ 0 in twelve revolutions.

The Kidea 12.2: The 0 on 2 on 4 on 6 on 8 on 10 on 0

The 1 on 3 on 5 on 7 on 9 on 11 on 1

Either Kidea 12.2 has 2 sides.

The Kidea 12.3 has 1 side and we reach facet n˚ 0 in twelve revolutions.

The Kidea 12.4: The 0 on 4 on 8 on 0

The 1 on 5 on 9 on 1

The 2 on 6 on 10 on 2

The 3 on 7 on 11 on 3

Either Kidea 12.4 has <u>4 sides</u>.

The Kidea 12.5 has 1 side and we reach facet n˚ 0 in twelve revolutions.

The Kidea 12.6: The 0 on 6 on 0

The 1 on 7 on 1

The 2 on 8 on 2

The 3 on 9 on 3

The 4 on 10 on 4

The 5 on 11 on 5

Either Kidea 12.6 has <u>6 sides</u>.

The Kidea 12.7 has 1 face and we join the facet n˚ 0 in twelve revolutions.

The Kidea 12.8 has probably 4 faces by induction of the symmetry of the result with respect to the middle (facet/2 for even numbers);

Let's check: The 0 on 8 on 4 on 0

The 1 on 9 on 5 on 1

The 2 on 10 on 6 on 2

The 3 on 11 on 7 on 3 Or indeed the expected result.

The Kidea 12.9 has 1 side and we reach facet n˚ 0 in twelve revolutions.

The Kidea 12.10 has probably 2 sides by recurrence of symmetry,

Let's check: The 0 on 10 on 8 on 6 on 4 on 2 on 0

The 1 on 11 on 9 on 7 on 5 on 3 on 1

Either effectively the expected result.

The Kidea 12.11 has 1 side and we reach facet n˚ 0 in twelve revolutions.

The results therefore have the property of symmetry with respect to the middle; and we will notice that the Kidea $n.1$ and $n.(n\text{-}1)$ have only one side for $n \in \mathbb{N}$.

13. A (thirteen) is a prime number, so its Kideas have only one side, and the canonical Kideas of 13 have 13 sides.

2.1. Same Twisted Tori with Concave Regular Polygons and Less Regular Shapes for Generator

We call concave regular polygons the star-shaped crosses and the stars as discreet sided extremes of umbrellas. The concave regular polygons have the same branches length and have therefore their vertices on the same circumscribed circle. The angles between two adjacent branches are the same. The regular crosses are concave regular polygons because of the thickness of the stroke. There are three kind of regular stars (meaning for the branches of the same length and at the same angle). The "regular stars" in itself, whose inner vertices are of the same length and at the same angle, the "fake regular standard stars", whose inner vertices are of the same length but at different angles, and the "fake regular stars" whose inner vertices are of different length at different angles. The "irregular standard stars" have branches of the same length but at different angles and the "irregular stars" that have different branches length at different angles. Those last two kinds of irregular stars can have "standard inner vertices" (of the same length) or/and "regular inner vertices" (at the bisector of the angle between two adjacent branches).

Concave regular polygons generate Kideas the same way as convex regular polygons. We denote the number of branches followed by the number of branch(es) of which it's twisted on the revolution. Figures 6-9 illustrate the polygons generators for KideaCross, KideaStar, and KideaUmbrella. We count the number of distinct branches globally in the same way as we did for the globally distinct surfaces of regular Kideas.

We have Kideas even for irregular concave polygons as generators that may vary on the revolution with continuous surfaces and with even accidental points as long as we keep a constant number of branches.

Figure 10 illustrate a cross together with a star-shaped generator of any kind.

In the same way we can solve the Kideas generated by irregular standard convex polygons (whose vertices are on the same circle), or irregular convex polygons, as long as we keep constant the number of "facets" on the revolution for the generator.

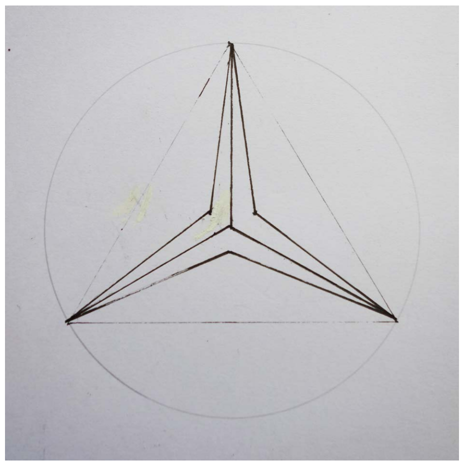

Figure 6. Generators for KideaCross 3.*n* and KideaStar 3.*n*.

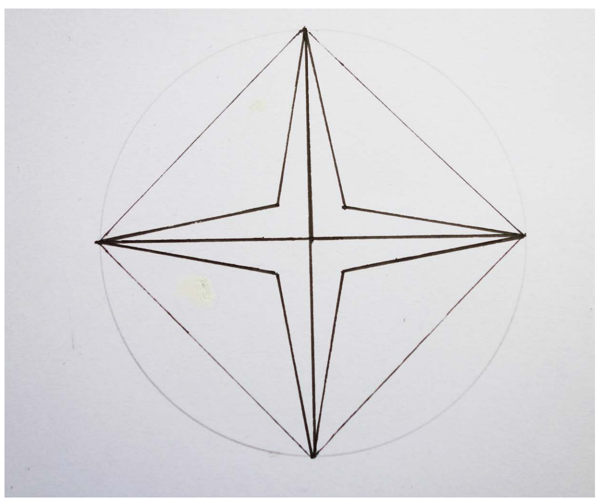

Figure 7. Generators for KideaCross 4.*n* and KideaStar 4.*n*.

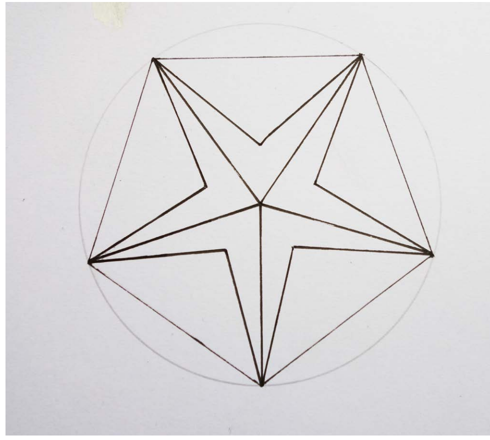

Figure 8. Generators for KideaCross 5.n and KideaStar 5.n.

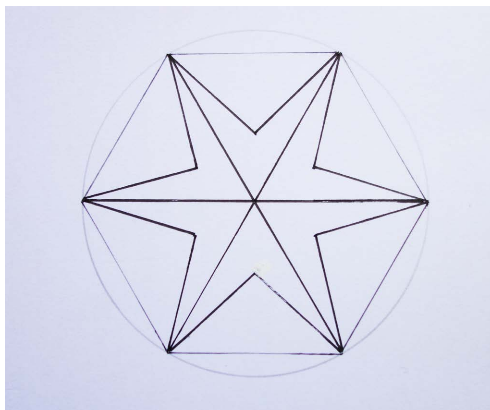

Figure 9. Generators for KideaCross 6.n and KideaStar 6.n.

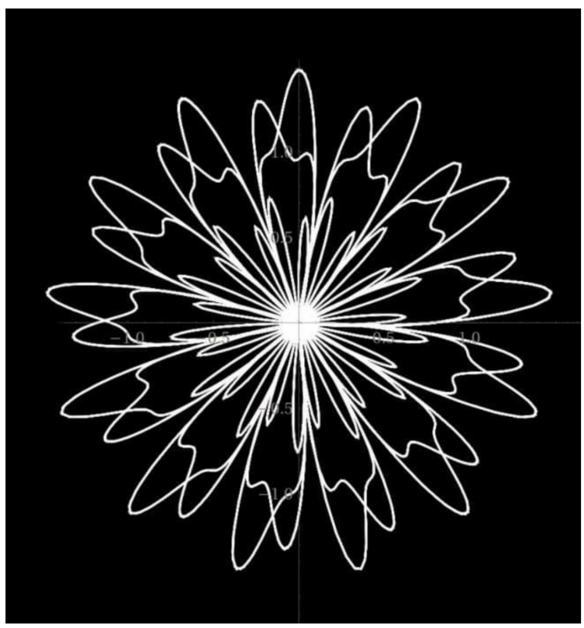

Figure 10. Cut out/add a triangle in the ear.

2.2. Algorithm for Calculating the Set of Prime Numbers $\mathbb{P}$

The method of programming the elements of $\mathbb{P}$ {set of prime numbers} is accelerated by applying the algorithm "+2+4" to the starting set from of 5; or base ten numbers: 5 7 11 13 17 19 23 25 etc. Indeed the divisible by 2 and by 3 are thus removed from the outset.

3. Conclusions

Kideas are hidden figures of the Euclidean geometry that may let think of heavenly things.

Hoping these and their topology will increase the mathematical, artistic and physicist worlds.

Acknowledgements

Photo credit goes to the talented photographer Patrick Cadier. **Figure 10** is a graphic creation of the mathematician Khvicha Matkava.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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