NEW MODEL OF THE COMPLEX PLANE WITH DIRECTED INFINITY

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Introduction

Properties of the complex numbers are very interesting, which is a combination of a real number and an imaginary number. These numbers are very useful in many fields including quantum mechanics, electric engineering, statistics, etc. Complex numbers are usually presented in the complex plane. Then Bernhard Riemann suggested an even more unique model of the complex plane called the Riemann sphere *(see Fig.1)*. Riemann put only one point of infinity as the absolute value of directed infinity. Riemann compactified space of complex plane with infinity in the form of a sphere where the North Pole is the point of infinity.

The problem: there is an uncountable number of infinity, especially in the complex plane, of the form ∞.e^(iα), where α ∈ {0, 2)

So, α = 0 → ∞, α = π → -∞,

α = π/2 → ∞i, and α = 3π/2 → -∞i.

And if infinity is multiplied with a complex number and written in polar form (with Euler formula), then it will get a directed infinity. Directed infinity is a type of number that has a defined angle θ but has an absolute value of infinity. So the purpose of this research is to **find a new Mathematical model as the ideal model for mapping all complex numbers, especially the complex infinity**.

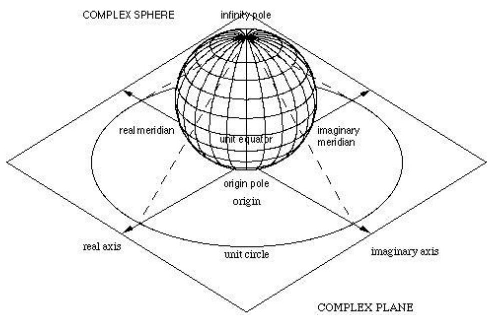

Fig.1, Riemann Sphere, as an extended Complex Plane

Experiment / Research Method

The first model is a circle at the bottom with a standard complex plane and a segment parallel to the z-axis hovering on the top of the circle, which is called the segment of infinity. Then some points on the circle are connected to some on the segment evenly spaced from their neighbors. But this seems wrong because it is not continuous. **The second model**, which focuses on the continuity, has been improved from the first one. This model *(see Fig.2)* has 3 main parts as follows:

a. Base. Suppose we have a circle and we place this circle around the center of a graph, which has a radius of 1. (Because 1 is the multiplicative identity), consisting of 2 axis (real and imaginary) just like the standard complex plane. This is where the numbers with an absolute value of less than or equal to 1 will be mapped to, however, it is also very useful for mapping numbers with an absolute value higher than 1.

b. Harmonic Wall. This is where numbers grow in magnitude from bottom to top by the Harmonic Progressive formula, magnitude=h/(h-n) where h is the height of the model and n is the height of the number.

c. Ring of Infinity. It contains any complex number multiplied by ∞. Opposing pairs of infinity have only 1 point in this "ring". It takes the form of a circle as the geometrical model for mapping the directed infinities because it is infinitely symmetrical of infinity. With this "ring" all complex infinity can be mapped.

Results and Analysis

With this new model, all kind of numbers are tested to be mapped. Especially complex numbers and directed infinity *(see Fig.2)*. This result proves that the research results as expected.

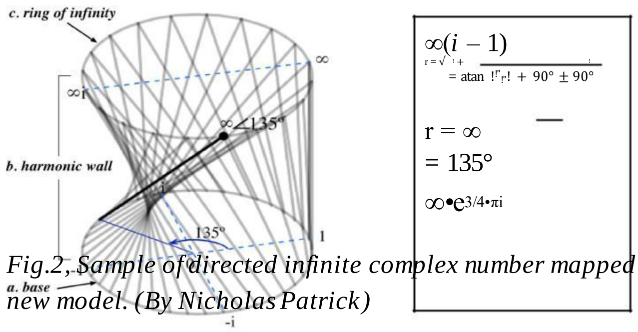

Fig.2, Sample of directed infinite complex number mapped in new model. (By Nicholas Patrick)

Conclusion

All real, complex, imaginary numbers, and directed infinity can be mapped correctly with the new model. So, this model can be propose to contribute in studies and possibly open a new way to solve problems in various fields, eg. electronic engineering, stability analysis, etc.

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