PakTech Today | Pakistan's Premier Technology Magazine
Vol. 01, Issue 13 • ISSN: 3136-2729

TECHNOLOGY FEATURE Industrial News / Technology Report / Research Communication

What If Everything You Called 'Beautiful' Was Actually Just Perfect Math?

We have always separated beauty from logic. But what if that separation was never real? What if the most breathtaking things in the world were just mathematics in disguise?

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Introduction

How seldom do we pause and ask our self why has the flower five petals and not seven petals? Why not flow straight down the river? Every day we observe and see everything that is around us but tend to look past how it was created. It is here that we find the truth which most of us have passed and have never taken the time to observe - that math is not something that exists and was made by human beings sitting in their classroom. Math was in existence long before us. And, all the twists of a seashell, the branching design in trees, or a snowflake that falls in the air are all based on a mathematical rule system. So soft, silent, and accurate are all things in mathematics - we have never bothered to read their tale. It is an experience article about reading that story; it is a chance to find out in something as mundane as those things in your everyday life, that under great beauty is something greater than great beauty; this is the invisible hand of math that makes it all stick together.

> ***"Mathematics is not a human invention imposed on nature. It is nature's own language, spoken long before we ever learned to listen."***

Technology Overview

Many people envision math as being impersonal and abstract; only live on a chalkboard or in an exam. But this attitude starts to dissipate the moment you open your door and start to really look around at the world around you.

Use an extremely simple object, like a sunflower. See the number of seeds in the middle of a sunflower head and see how many there are compared with the number of spirals which surround the flower head. You will observe that there are 34 spirals in one direction round the head and 55 in the opposite direction (i.e. clockwise/anti-clockwise). The total number of spirals in these two opposing directions are actually very significant as they represent two successive numbers in the Fibonacci series — each in succession is equal to the sum of the two previous numbers: 1 + 1 = 2; 1 + 2; = 3; 2 + 3 = 5; 3 + 5 = 8; 5 + 8 = 13; 8 + 13 = 21; 13 + 21 = 34; and finally 21 + 34 = 55. The Fibonacci sequence can also be found in other patterns of nature like the spiral forms of nautilus shells, the arrangement of the leaves on a stem, the arrangement of scales on a pinecone and the shape of an ocean wave as it crashes. Nature has not studied the Fibonacci Sequence as a schoolbook, but has learned over many millennia to cope with similar problems: to make the best use of space by growing, packing and expanding.

Look closely at trees, not just an individual tree's appearance but at how it develops. The tree trunk has many branches, each with their own set of smaller branches, and so forth, with the same pattern repeating at each successive level. This is called a fractal or a geometric shape that has more than one repeating pattern at each level of view. From this we know that what may appear disheveled or erratic, is governed by a mathematical formula. Examples of where to see fractals are in waterways, mountains, clouds and within the structure of your own lungs.

When we think of calculus and motion in general, we can think about the way a falcon dives to catch a pigeon, as it "solves" an optimization problem while in auto-pilot by calculating its speed, the angle of incidence and when exactly to pull up from it. Likewise, the path that water takes around a boulder in the river is the result of principles of fluid dynamics and the mathematical precision whereby engineers are trying to re-create this process through their designs and calculations. The smoke from a candle also follows a very complex set of differential equations and researchers are still trying to examine and fully understand this process.

The geometry of mathematics is perhaps the single largest visible manifestation of mathematics. Honeybees make their honeycomb out of hexagonal cells because the hexagon is the figure that occupies the largest area for the least amount of wax. The geometry of water causes snowflakes to possess six-fold symmetry. Spider webs have logarithmically spiraled forms that optimize the distribution of tension and use exactly the same mathematical principles that are used to design suspension bridges.

For the most part geometry in nature is not by accident. There is no such thing as decorative geometry in nature. There is a mathematically desirable reason why all patterns, shapes, and curves exist in nature.

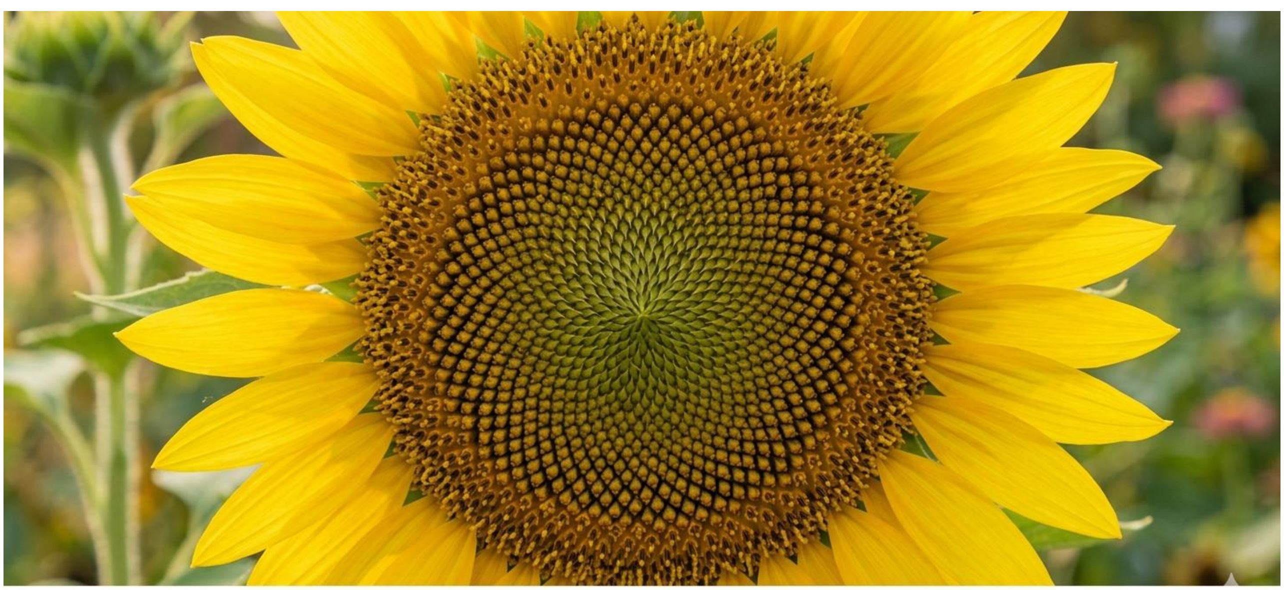

Figure 1: Fibonacci spiral pattern visible in a sunflower head demonstrating nature's mathematical precision.

Credit: Visual generated by Gemini/https://gemini.google.com

Key Findings & Impact

This is not just an interesting thought. It has important practical implications on the way we apply technology and solve problems in real world.

The field of Biomimicry (technology design by learning and copying nature) is booming as engineers are discovering that nature has already solved many of their hardest problems and accomplished much more efficiently than any human team might have done so. This can be seen in the examples of our current algorithms in computer science which are directly based on natural processes like Genetic Algorithms (based on biological evolution), Neural Networks (based on the structure of the brain), and Swarm Intelligence (based on the collective decision-making of ants or bees without any central control).

Although the study of Fractal Geometry enables us to create better antennas to pick up signals over a large spectrum of frequencies, the discovery of new means of approaching Fluid Dynamics with Calculus has transformed aircraft and ship design. Knowledge of the probability patterns in random natural processes has enabled us to come up with improved models of weather prediction, to come up with improved approaches of coping with natural catastrophes, and to design improved infrastructure.

Mathematics, nature, and technology have a direct relationship that is occurring in real time throughout research facilities and engineering teams across the globe. What unites mathematics to nature and technology is the simple understanding that there is no separation between logic and nature—they are one in the same; nature is the clearest manifestation of logic that has ever existed.

For students and professionals working in Pakistan's rapidly expanding technology industry, this perspective is very relevant and important. With more money being spent on artificial intelligence, data science, and software programming, the greatest source of creativity and innovation often does not originate inside the four walls of a laboratory. Many times, ideas can be found by looking at the landscapes in which we live, watching the flow of our rivers, and observing the forms of plants that grow around us. To learn how to see the mathematics hidden in nature is more than a purely academic or scholarly activity — it is a way of thinking that can help create a newer generation of technology, design, and solutions.

"Innovation begins when we stop calling nature beautiful and start calling it precise."

What's Next?

There is a significant lack of awareness about how quickly the lines are blurring between our natural and digital worlds. For example, quantum computing is based on probability and the behavior of subatomic particles; artificial intelligence learns in the same manner as biological brains; and the next generation of materials science is exploring how bones and shells derive their fantastic strength from their geometric and structural properties instead of their mass.

We are headed into an era where we combine the strictest mathematics in nature with the most advanced technological products created by human beings. The only question left to answer is whether we will be brave enough to look closely enough to find it and to think creatively about how to apply what we find.

For anyone who has ever sat in a math classroom asking why it should matter - the answer is right outside your window. It's in the spiral of a shell, in the branches of a tree, in the path water travels down the side of a hill. The math wasn't dead or abstract, it has always been alive! It has always been moving, and it has always been right in front of you.

"We did not invent math! We have finally become good enough to see it."

About the Author

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Keywords: *Mathematics in Nature; Fibonacci Sequence; Fractal Geometry; Biomimicry; Fluid Dynamics; Computational Thinking; Pakistan Tech.*

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