Discrete to continuity through the visualisation of waves

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INTRODUCTION

1D DISCRETE TO CONTINUITY

A single dimension (1D) is equivalent to a number line such as the following sets: the set of all natural numbers $\mathbb{N}$, the set of all integers $\mathbb{Z}$, the set of all rational numbers $\mathbb{Q}$, the set of all real algebraic $\mathbb{A}$, the set of all real numbers $\mathbb{R}$, the set of all imaginary numbers $\mathbb{I}$ and the set of all complex numbers $\mathbb{C}$. Where a single number represents one point of data x from that one dimension. For example we denote a single point from the complex set as $x \in \mathbb{C}$.

A series of numbers may represent several points, several lines, a singular line or both, where a series of neighbouring numbers represents a line denoted by $x_1, x_2, x_3, ...x_n = (x_2, x_{n-1})$ or $[x_1, x_n]$ where , denotes a set of numbers, (,) denotes exclusive range of numbers and [,] denotes inclusive range of numbers.

A series of non-neighbouring numbers represents points denoted by $x_1, x_2, x_3, ...x_n$ where $(|(x_n - x_{n-1})^2|)^{0.5} \neq 1$. We define discreteness for 1D as points while continuity is defined by a line. Discrete points become continuous when the points within the observed range are all connected by a neighbouring point.

Another way to perceive this is that continuity in 1D is where all unique points form the shortest possible connected network without any points in between the connections. Continuity ceases to exist when the 1D network is not fully connected. Let's say point x_a and x_b are connected in the set x_a, x_b, if $[x_a, x_b]$ contains more than the elements in the set x_a, x_b then this network is not fully connected and not continuous.

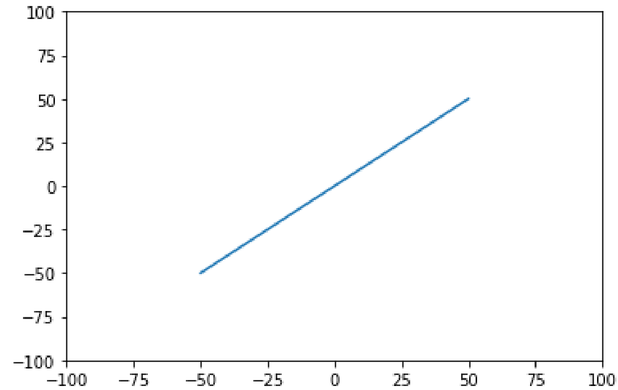

FIG. 1. A line of 50x50 produced by a single wave equation $g(x) = Asin(fx)$ where $f = 1E-3$, A = 1000 and x = [-50,50].

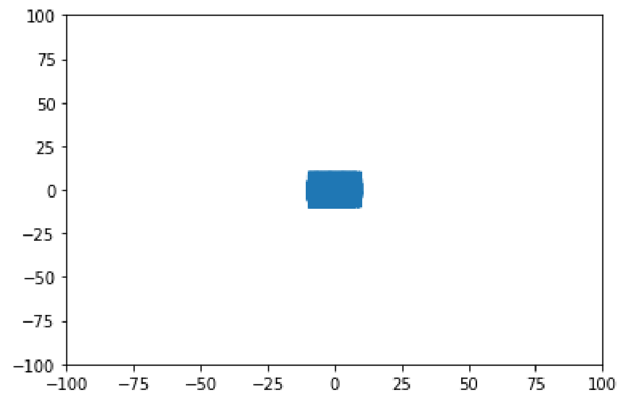

FIG. 2. An area of 10x10 produced by a single wave equation $g(x) = Asin(fx)$ where $f = 1E8$, A = 10 and x = [-10,10].

2D DISCRETE TO CONTINUITY

In two dimensions (2D) the data contains two independent variables which is portrayed as two perpendicular spaces in a Cartesian plot. It is now possible to have: vertical lines, horizontal lines, normal distributions, waves, areas and spirals. These can be defined as a function of x, $f(x)$. Even areas can be created by created by a single function using wave equations where the frequency is very large.

Discreteness becomes continuous in a 2D space when all observed points are connected to each other by neighbouring points. This is without any points between the connections. If this rule is not obeyed within an observed space, then the set of 2D points must have at least two from the following: discrete points, lines, normal distributions, waves, areas or spirals.

Note that two discrete normal distributions are individually continuous. If the normal distributions are summed together they become a continuous wave. If they are summed together where their means are located at 1/4 and 3/4 of the total length of the wave then the wave is approximately sinusoidal.

2D POLAR DISCRETE TO CONTINUOUS

In 2D polar coordinates, it is possible to create points, circles, polar normal distributions, polar waves, spirals and polar wave spirals. All of these except for points are continuous. Note that it is possible to create two discrete polar normal distributions which individually are continuous.

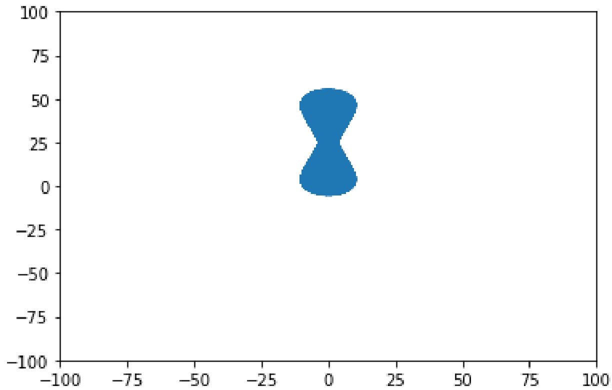

FIG. 3. A hyperbolic area produced by a single wave equation $30sin(0.5f(x-25)) + 25 = Asin(f(x-25))$, where $f = 1E8$, A = 10 and x = [-10,10].

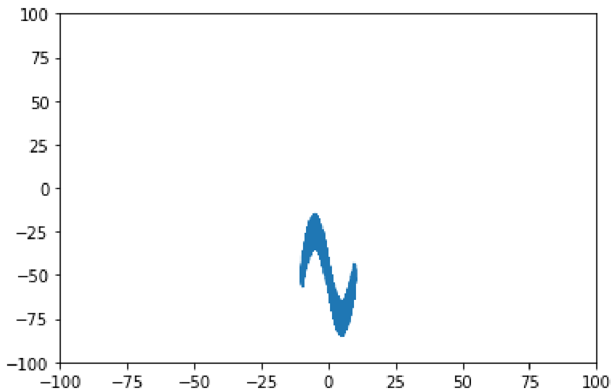

FIG. 4. A wave area produced by a single wave equation $g(x) = Asin(fx) + 25sin(\pi fx) - 50$, where $f = 1E8$, A = 10 and x = [-10,10].

3D DISCRETE TO CONTINUOUS

In 3D space, there can be points, vertical lines, normal distributions, waves, planes, 3D shapes and 3D objects.

Discreteness becomes continuous in 3D space when all observed points are connected to each other by neighbouring points. This is without any points between the connections. If this rule is not obeyed within an observed space, then the set of 3D points must have at least two from the following: discrete points, lines, normal distributions, waves, planes or 3D shapes/objects.

3D SPHERICAL COORDINATES DISCRETE TO CONTINUOUS

In 3D spherical polar coordinates there exists: points, waves, spirals, rings, polar waves, spherical waves, 3D shapes and 3D objects.

Discreteness becomes continuous in 3D spherical polar space when all observed points are connected to each other by neighbouring points. This is without any points between the connections. If this rule is not obeyed within an observed space, then the set of 3D points must have at least two from the following: discrete points, waves, spirals, rings, polar waves, spherical waves or 3D shapes/objects.

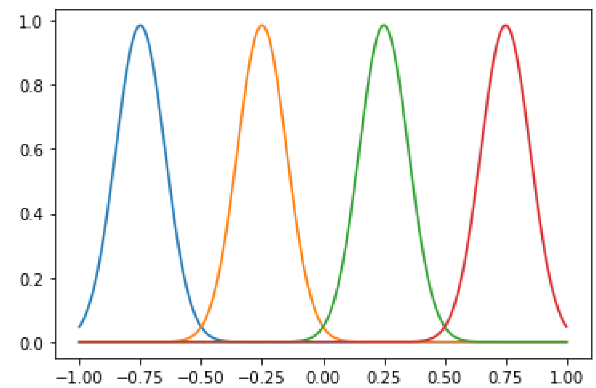

FIG. 5. A sequence of normal distributions.

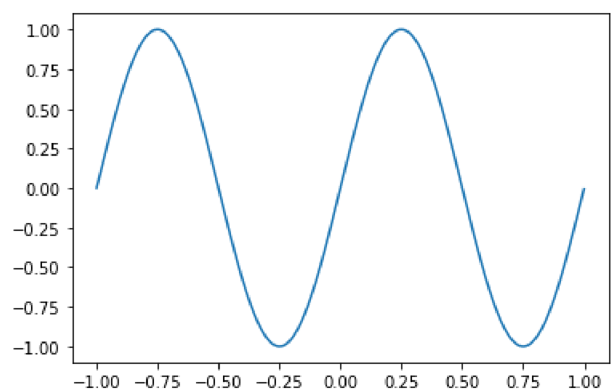

FIG. 6. A typical sinusoidal wave, $g(x) = (2/L)^{0.5}sin(kx)$ where $k = 2\pi$, $f = 2$, $\lambda = 1$, $L = f\lambda$ and $x = [-0.5\lambda, 0.5\lambda]$.

DISCRETE TO CONTINUITY SPRINGS

A compressed spring can be considered to be a single cylinder, whilst an uncompressed spring may be considered to be multiple rings. If stretched to a straight wire the spring is now a continuous line. Note that an infinitely compressed spring would become a single continuous line which is perpendicular to the stretched wire.

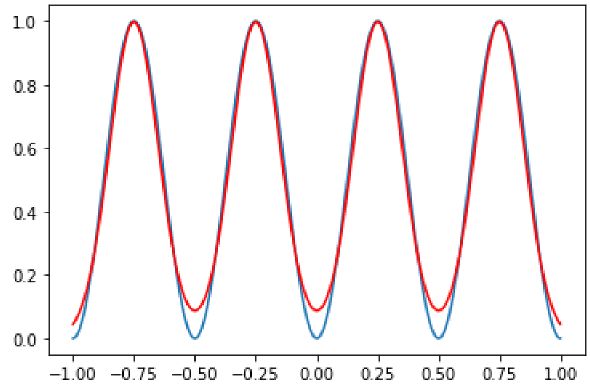

FIG. 7. Series summation of normal distributions in red and a probability wave distribution constructed from $|g(x)^{*}g(x)|$ where g(x)* is the complex congregate of g(x).

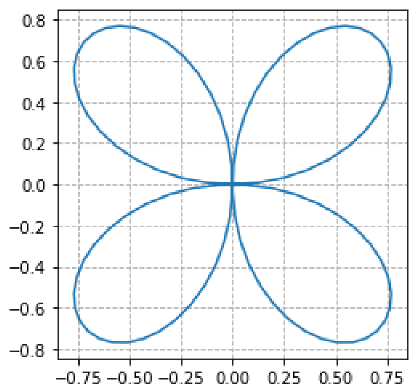

FIG. 8. Polar wave where $r = sin(2\theta)$, $x_1 = rcos(\theta)$ and $x_2 = rsin(\theta)$

CONCLUSION

[1] J Earman, M Friedman. *The meaning and status of Newton's law of inertia and the nature of gravitational forces*. (1973). The University of Chicago Press Journals.

[2] D Breuer, S Labrosse, T Spohn. *Thermal evolution and magnetic field generation in terrestrial planets and satellites*. (2010). Springer.

[3] A.P. Vanden Berg, D.A. Yuen, G. Beebe, M.D. Christiansen. *The dynamical impact of electronic thermal conductivity on deep mantle convection of exosolar planets*. (2010). Elsevier.

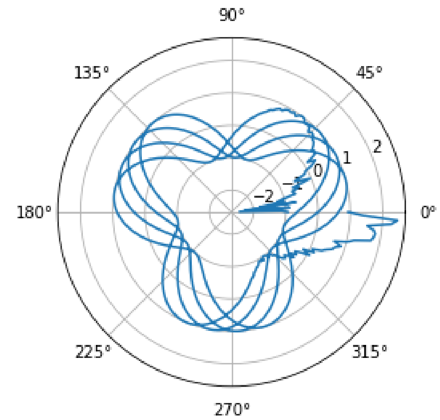

FIG. 9. Polar wave spiral, where $g(x) = Wexp(-2\pi fxi) - exp(\pi i)$, where $W = 1$, $f = 0.99/2$ and $x = [-4\pi, 4\pi]$.

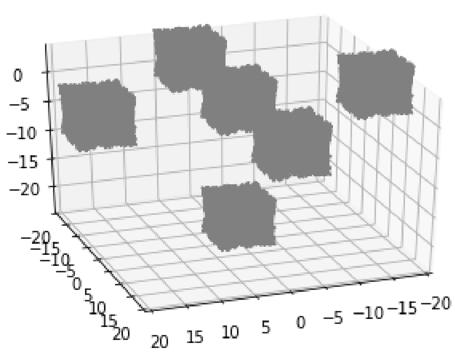

FIG. 10. Six cubes produced by wave equation.