Time and Space

Dr. Ziad Sobih *sobih84@gmail.com*
Northeastern University
Boston, MA, USA

Prof. Marten Schetzen
MIT
Boston, MA, USA

Abstract

In this paper I will try to develop a theory that will relate time and space. I will try to develop a model that might be used to understand the idea of time and space.

Keyword: Projection, Correlate, Orthogonal.

1. INTRODUCTION

I want the reader here to think of a pizza of 12 slices. Before taking any slice of the pizza (the pizza is complete) as we take the projection of the pizza in all directions we will get the same function. For simplicity let us make the model digital. Let us take 12 projections. Starting from 0 degrees were we have the edge of the first slice rotating 15 degree around the pizza and taking the first projection. Then rotating around the pizza 30 degree and taking the second projection .We do that to get the 12 projections. Here we will get the same 12 functions. Here we can say that the functions are dependent (time) the opposite of independent (space).

2. THE MODEL .

As we take the first slice of the pizza from 0 degree to 30 degree. and we take the 12 projections starting at 15 degree for the first projection and rotating 30 degrees around the pizza for each another projection. We will get 12 functions that are more independent. Here we can say we are going from time to space.

As we take the second slice of the pizza (from 0 degree to 60 degree of). And we take the 12 projections starting at 15 degrees and rotating 30 degree for each projection. The more independent the functions will be

As we can see as long as we are in the first quarter the more slices we take the more independent the projection functions will become. By that I mean the more orthogonal they will be. We can say here that we are going from dependent to independent (more orthogonal) functions or from time to space.

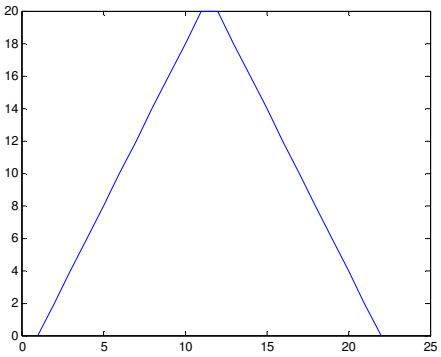

FIGURE 1

At this point a computer is needed to correlate data. Also a measurement of orthogonality is needed. We have for each case 12 deferent functions. From some work I did I found that the dimensionality for each case of the 12 functions is three. Which is consistent with the three dimension space in nature. By that I mean 3 functions out of the 12 functions can be used as bases to generate all 12 functions.

Using the same method. As we start taking slices from the second quarter of the pizza the 12 projection functions will become more and more dependent (going from space to time). In fact the maximum dependency we will get at 50% of the pizza. At this point we can say we are back to time.

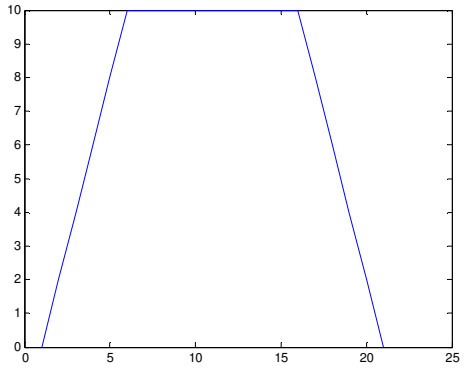

FIGURE 2

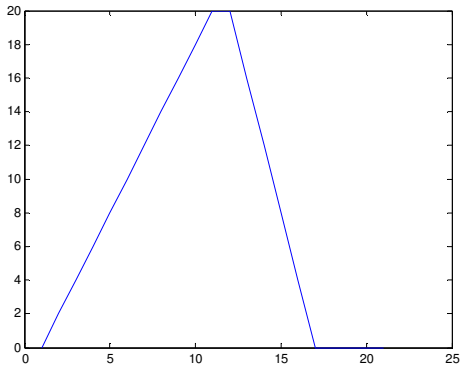

FIGURE 3

Using the same method. As we start taking slices from the third quarter of the pizza the 12 projection functions will start converting from dependent (time) to independent (space). In fact the maximum orthogonality of the 12 projection functions will happen at 25% of the pizza. At this point we can say we are back to space. This is similar to the fact that a baby stays 9 month inside his mother (3 quarters of the year).

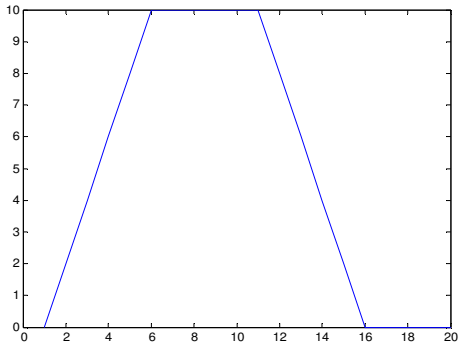

FIGURE 4

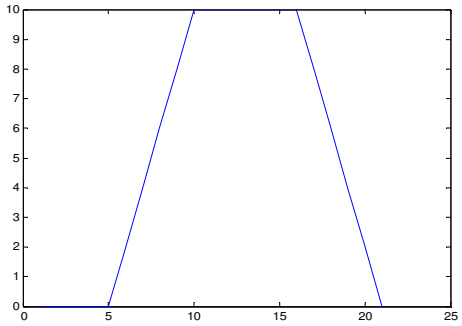

FIGURE 5

In the history of science and technology class in 1990 I had a feeling that the two equations E=1/2 m*v2 (were E is the Kinetic energy and m is the mass and v is the velocity) and E=m*c2 (were c is the speed of light) are related. My justification was that c is the speed limit but I was not able to justify the ½ factor. Dose this work justify that? are we in the 50% of the pizza domain for E=1/2 m*v2 and we are in the 100% of the pizza domain for E=m*c2 ?

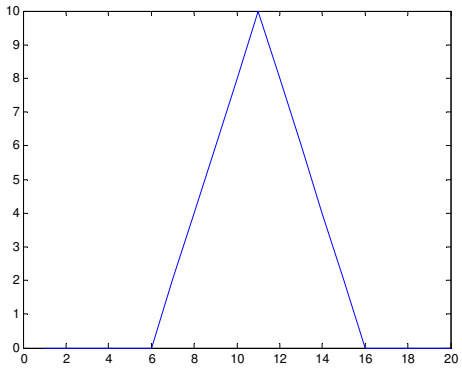

FIGURE 6

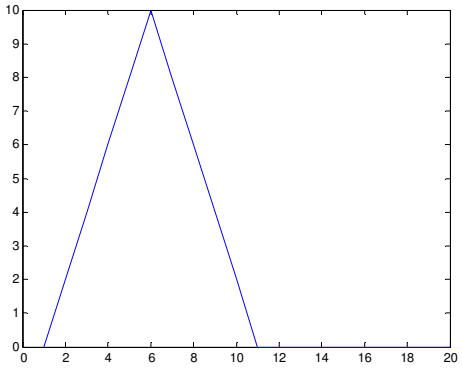

FIGURE 7

I am discussing a possible analogy for certain relativistic results. Any analogy that helps us to better understand the physics is fine. However, you must realize that analogies have their limitations. For example, water is sometimes used as an analogy for the flow of electric current in a circuit. This analogy has been very helpful for many students in their understanding of electric circuits. In using an analogy however, one must understand its limitations. Remember, science really only constructs models of observed phenomena. The excellence of the model depends on how well it predicts observed experimental results. If predictions from the model do not correspond with experimental results, the model is modified until there is agreement. I discuss this in Chapter 1 of the book "Airborne Doppler Radar: ... " which was published by the AIAA (American Institute of Aeronautics and Astronautics). In that chapter, the basic philosophical view of science is discussed.

3. SPACE

In the history of science and technology class in 1990 I was able to proof that the universe is bounded. This is the proof. If we have a plate as the plate rotate at angler speed w. The tip of the plate will have a speed r.w (were r is the radius of the plate). As the radius gets larger the tip speed gets larger. But we know that the speed limit is c. As a result we can conclude that the universe is bounded. In fact, it is bounded by the relativity curve.

This is like Columbus and the age any body could have done it but no body did.

The question now is how can we integrate the bounded universe theory with the pizza model to come up with a clock that best describe the time and space system of the universe. An orange might help? But how?

About my thoughts about the finiteness of space, the analogy often used is that of the surface of the earth. The earth's surface is finite, yet one can travel an infinite distance on it without ever crossing a previously traveled path. It is, of course, the curvature of the earth's surface that is the basis of this. Einstein showed that a good model is to represent space as being curved from which one arrives at the "finiteness" of space.

4. SPECTRUM AND CLOCKS

A question that use to come to my mind while I am studying the spectrum of a signal is how much of time do we have to take ? Were do we start and were do we end?

To analyze this question let us think of simple and fundamental signal such as an exponential with time constant (t1). I think it is clear that if we take (5*t1) time we will have most of the information we need to find the spectrum.. Also I think of the inverse relationship between the time domain and the frequency domain ? It is clear for such a signal the cut of frequency is (1/t1).

This mean that the time constant is a parameter for the signal in the time domain and for the spectrum in the frequency domain .

At a specific instant we can not find the spectrum because to find the spectrum we have to integrate time out. But I am trying to find how much time do we need ? I think this is an estimation problem.

Another interesting fact is when we take a slower time frame or a faster time frame? And the relativity between two time frames? We might feel the inverse relationship between doubling the time constant lowering the bandwidth by the half factor?

Also interesting is clocks relative to each other? Say we have clock 1 and clock 2 and there is an integer number of clock 1 in clock 2 or the other way around.

At this point we can say the two clocks are in resonance? Or let me say that one clock is in the *orbit* of the other. I think in this example the inverse law relationship is clear and the relation between the time domain and the frequency domain can be seen?

Please think of the phasor diagram of sin massage AM signal were the origin is the sun and the earth is rotating around the sun as the tip of the carrier phasor and the moon rotate around the earth as the tip of the massage phasor from the tip of the carrier phasor. This motion can be filtered by a band pass filter With lower and upper cut off frequencies as the lower and upper side bands. Can we say that this filter resonate with this system?

This bring to my mind the sin massage FM and the spectrum of it. Please note that we have a carrier and side bands that are separated By the frequency of the massage?

I am very pleased and happy that I am still thinking deeply about science and engineering even though I have not been directly involved in it for quite a while. I do hope I continue to study and think about it .

Now, about "The Time Constant". First, the problem to which I refer in my paragraph has been a major one that has been studied for many years. It is one of the important topics discussed in the mathematical area of Harmonic Analysis.

In the paragraph, you should note that the concept of a 'time constant' has meaning only for a time function consisting of only exponential. For general waveforms, the problem I discuss is not a simple one. In the other paragraphs, I am referring to a phasor representation. In AM, the phasor representation of the modulation consists of two phasors rotating about the carrier phasor as I describe. In FM, an infinite number of such phasors are required (This representation gives a nice physical view of why there are an infinite number of harmonics in FM but not in AM].

I mention a possible relation to resonance. Resonance is a much different concept so that any modeling of a similarity between them would only be for mental convenience but would not have any basis for scientific considerations.

5. RESULTS

All simulation graphs given use a square instead of the pizza to simplify things. As we can see from our simulation results when the square is complete as we take four projections starting from 45 degrees and 90 degrees apart we will get four same and dependent functions Fig 1.

When one quarter of the square is off, as we take four projections starting from 45 degrees and 90 degrees apart, we will get three functions fig2, fig3. We will use the correlation factor as a measure of dependency. We find that the correlation factor of fig2 and fig3 is 2/3 and the correlation factor between fig3 and the third function is 0.90.

As we take one half of the square as we take four projections starting from 45 degrees and 90 degrees apart we will get two functions fig4 and fig5. These two figures are correlated by 66%.

When one fourth of the square is left, as we take four projections starting from 45 degrees and 90 degrees apart we will get three functions two of them are fig6 and fig 7 which are correlated by 33%.

If we take this data to the frequency domain we will find that there is a fundamental that depend on the size of the square. If the square is small the frequency is fast and if the square is large the frequency is slaw.

When one forth of the square is off, we have three signals which have two frequencies fig9 and fig10. Also when half of the square is off we have two signals with one dominating frequency fig11. When one forth of the square is left we have three signals of the same frequency fig 12.

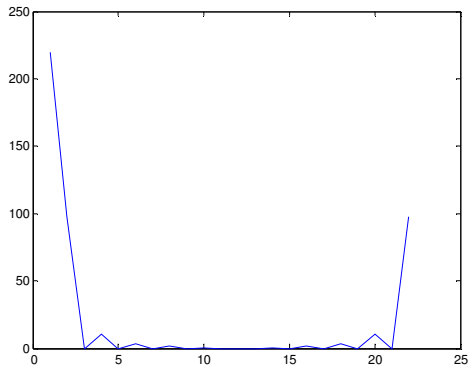

FIGURE 8

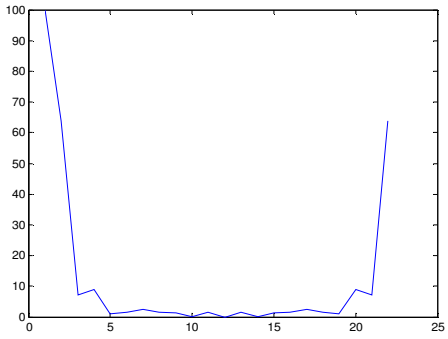

FIGURE 9

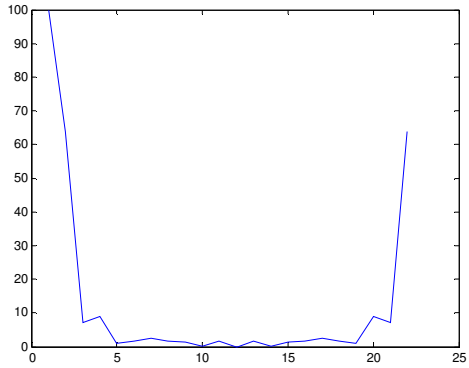

FIGURE 10

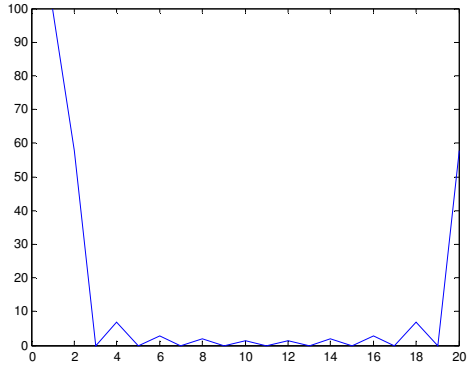

FIGURE 11

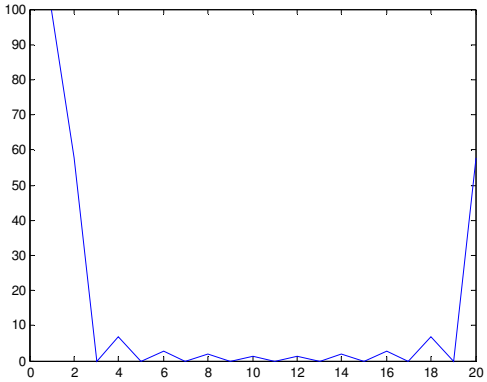

FIGURE 12

6. FUTURE RESEARCH DIRECTIONS

I think the future is to build a clock based on this theory. Let us think of a matrix 16x16. In the low right corner it has a matrix 2x2 and this matrix rotate as a function of time one cycle/sec. The next matrix is 4x4 in the low right corner rotate around it center one cycle/min and this rotation include the first 2x2 matrix. The third matrix is 8x8 matrix in the low right and rotate around it center one cycle/h. The fourth matrix is 16x16 and rotate around its center one cycle/day and so on.

If we project the matrix up and to the right we will have two waves that change as a function of time we can call them male and female because they complete each other to describe the matrix.

The amplitude spectrum of the projection do not change as a function of time so we can call it space.

Trying to built this kind of clock I think is potential for future research.

7. COMPARATIVE EVALUATION

This idea is by Prof. Arvin Grabel (the author of the microelectronics book) in the history of science and technology class. When I was doing my masters in the winter of 1991 I was the teaching assistant for Prof Martin Schetzen. At that time Stephen Hawking came to Northeastern University to give a lecture about time and space. Scientist at that time were trying to find one physics law that can explain atomic level phenomena and also explain the universe. One physics model for the small and the big. Dose this work do that? May be may be not?

The matrix model came to my mind from a lecture by Prof Ali Abur the electrical engineering chairman at northeastern university in power systems and network matrix class.

8. REFERENCES

[1] A. Papoulis , Probability , Random Variables, and Stochastic Process,2002.

[2] J. G. Proakis , Digital Communications, 2001.

[3] R. J. Schilling , Engineering Analysis ,1988.

[4] H. L. Van Trees , Detection, Estimation, and Modulation Theory,1968.

[5] J. G, Proakis , Inroduction to Digital Signal Processing ,1988.

[6] C. Chen , Linear System Theory and Design , 1984.

[7] S. Haykin , Communication System ,1983.

[8] T. H. Glisson , Introduction to System Analysis, 1985.

[9] Martin Schetzen, Airborne Doppler Radar, 2006.

[10] Martin Schetzen, The Volterra & Wiener Theories of Nonlinear Systems,2006.

[11] Martin Schetzen, Discrete System using Matlab, 2004.