# The Third Original Idea: Communication and Clocks


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THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

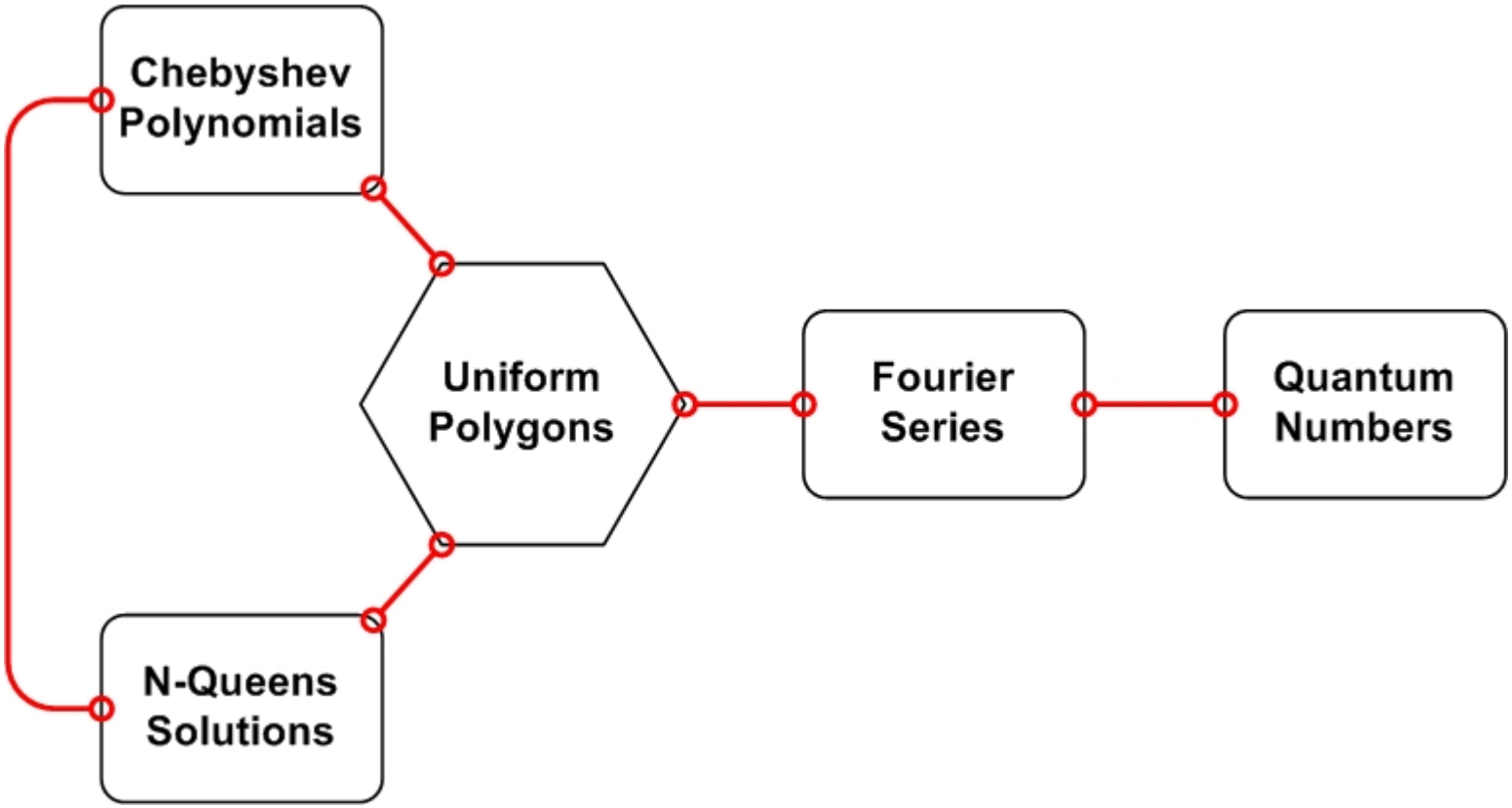
# Presentation is based on these publications

- **Genetic region characterization (Gene RECQuest) - software to assist in identification and selection of candidate genes from genomic regions**, Rajani S Sadasivam, Gayathri Sundar, Laura K Vaughan, Murat M Tanik, and Donna K Arnett, *BMC Research Notes 2009, 2:201,* http://www.biomedcentral.com/1756-0500/2/201
- **An Overview of Statistical Decomposition Techniques Applied to Complex Systems.** Y. Tuncer, M. M. Tanik, D. B. Allison, *Computational Statistics and Data Analysis*, 52 (2007), 2292-2310
- **Towards sound epistemological foundations of Statistical methods for high-dimensional biology**.T. Metha, M. M. Tanik, and D. B. Allison, *Nature Genetics,* Vol. 36, 9, 2006, 943-947.
- **An Information Theoretical Framework for Modeling Component-Based Systems,** R. Seker and M. M. Tanik, *IEEE Transactions on Systems, Man, and Cybernetics*, Vol. 34, 4, 2004, 1-10.
- **Fourier series and Bohr's atomic model**," B. Ozaydin, R. Seker, and M. M. Tanik, " Tech. Rep. 2001-09-ECE-010, UAB.
- **Interdisciplinary Design and Process Science: A discourse on Scientific Method for the Integration Age**. M. M. Tanik and A. Ertas, *Journal of Integrated Design & Process Science, Transactions of the SDPS,* Vol.1, No.1, pp.76-94, 1997.

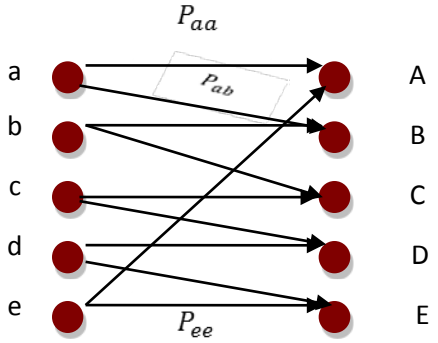
# The Big Picture: History of Knowledge Generation and Dissemination

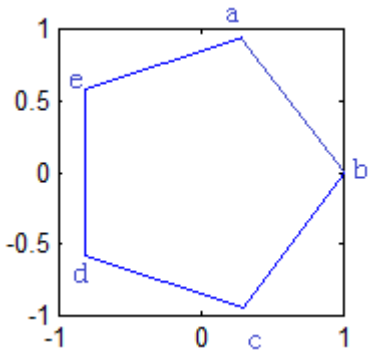
| Method | Era | Teaching | Automation Need | Social Machinery | Research/ Education |
|---|---|---|---|---|---|
| a) Deductive reasoning (Plato)<br><br>b)Observation and logic (Aristotle) | Platonic/ Aristotelian | Primarily based on authority and regurgitation | Minimal | Plato's Academy<br>Aristotle's Lyceum | Ad Hoc |
| Experimentation (Descartes) | Cartesian-Mechanistic | Primarily based on instruction | Increased | Universities | Primarily disciplinary |
| Meta-fusion (systematic knowledge generation) | Combinatorics/ integration | Primarily based on facilitation | An integral part of the method | Integrated universities and polytechs guided by institutes of technosciences in the technopolices of the next century | Primarily Transdisciplinary |

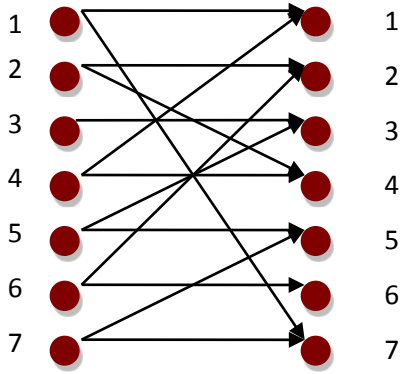
# Perspective on the Mathematics Utilized

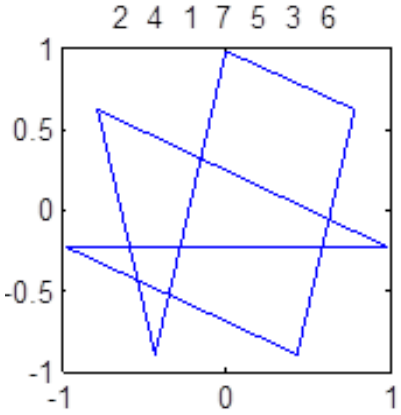


# Communication Channel and Clocks: Correspondence



**Fourier Series in General Form:**

$$f(t)=\sum_{k=-\infty}^{\infty} c_k e^{jw_0 kt}$$

Uniform Polygon $\begin{Bmatrix} n \\ q \end{Bmatrix}$

**Fourier Series of Uniform Polygon:**

$$f'(t)=\sum_{l=-p}^{p} \frac{1}{(q+nl)^2} e^{j(q+nl)t}$$

$$-l \le p \le l$$

**Quantum Numbers:**

| | |
|---|---|
| $n$ | Any number |
| $\ell$ | 0 to ($n$-1) |
| $m_\ell$ | $(-\ell)$ to $\ell$ |

**Fourier Series of Uniform Polygon for Corresponding Quantum Numbers**

$$u'_\ell(t)=\sum_{m_l=-\ell}^{\ell} \frac{1}{(q+nm_\ell)^2} e^{j(q+nm_\ell)t}$$

**Corresponding $m_\ell$ orbital**

$$u_{m_\ell}(t)=\frac{1}{(q+nm_\ell)^2} e^{j(q+nm_\ell)t}$$

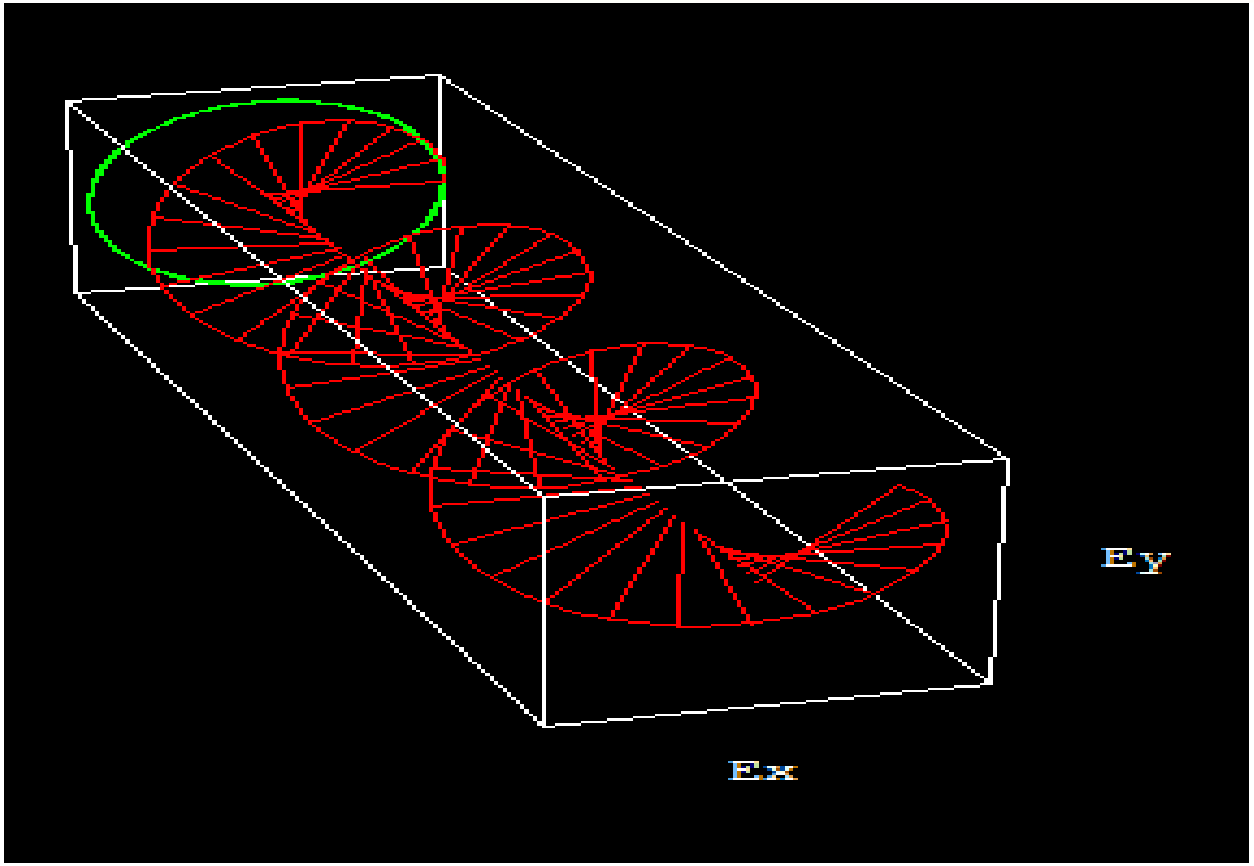
**Corresponding $\ell$ subshell**

$$u'_\ell(t)=\sum_{m_l=-\ell}^{\ell} \frac{1}{(q+nm_\ell)^2} e^{j(q+nm_\ell)t}$$

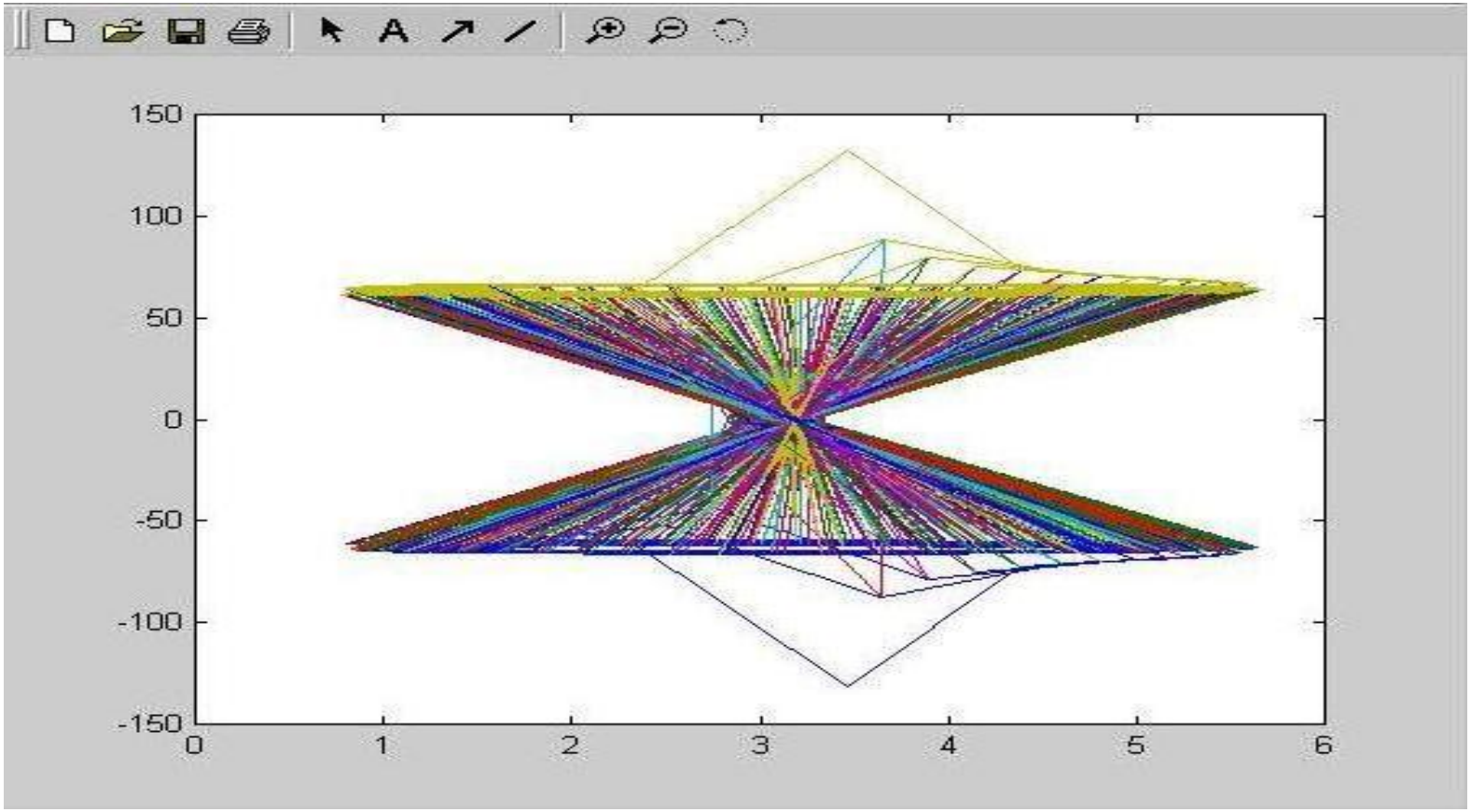
**Corresponding $n$ shell**

$$u''_n(t)=\sum_{\ell=0}^{n-1}\sum_{m_l=-\ell}^{\ell} \frac{1}{(q+nm_\ell)^2} e^{j(q+nm_\ell)t}$$

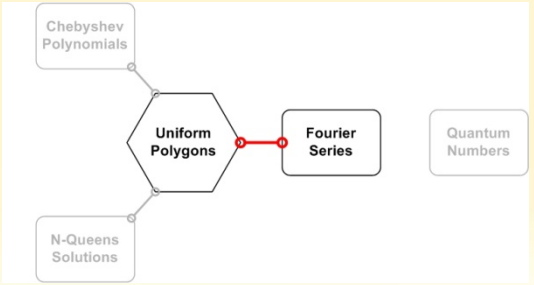
# Visualization of Elliptical Polarization : Classical case



# Visualization of Entangled Quantum Communication Channel : Particle, Wave, and Communication system – Computon



# A Slice of Space-time Cone using Fourier Series



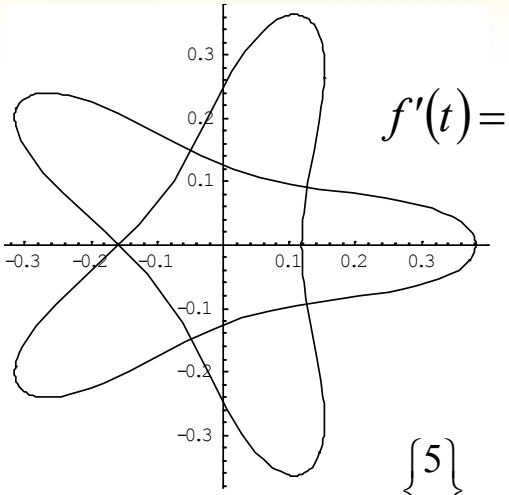

- **General form of complex Fourier series:**

$$f(t)=\sum_{k=-\infty}^{\infty} c_k e^{jkt}$$

- **Fourier series for uniform polygons**

$$f'(t)=\sum_{l=-p}^{p}\frac{1}{(q+nl)^2}e^{j(q+nl)t}$$

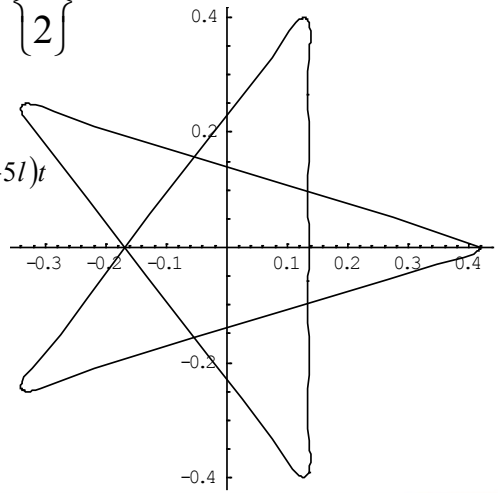
  - $q$ : difference of two vertices that are connected by side
  - $n$ : number of vertices
  - $p$ : resolution of polygon plot

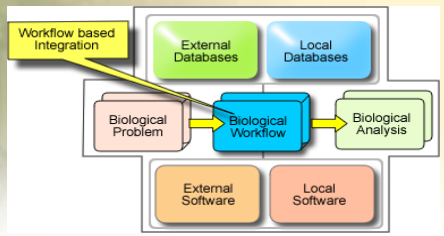



$$f'(t)=\sum_{l=-1}^{1}\frac{1}{(2+5l)^2}e^{j(2+5l)t}$$

$$\begin{Bmatrix}5\\2\end{Bmatrix}$$

$$f'(t)=\sum_{l=-4}^{4}\frac{1}{(2+5l)^2}e^{j(2+5l)t}$$






# An Application Area: Axiomatic Foundations for Biology and Medicine

- **Existing limited use of mathematics and formal systems primarily descriptive**
- **There is no axiomatic foundations similar to classical and modern theories of physics**
- **Chemistry is the accepted level of bridge between biology and physics**
- **Notion of communications has not been formally applied despite ample practical evidence of the fundamental nature of communication in biological systems**

# THANKS

**For Questions and collaborations contact:**

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