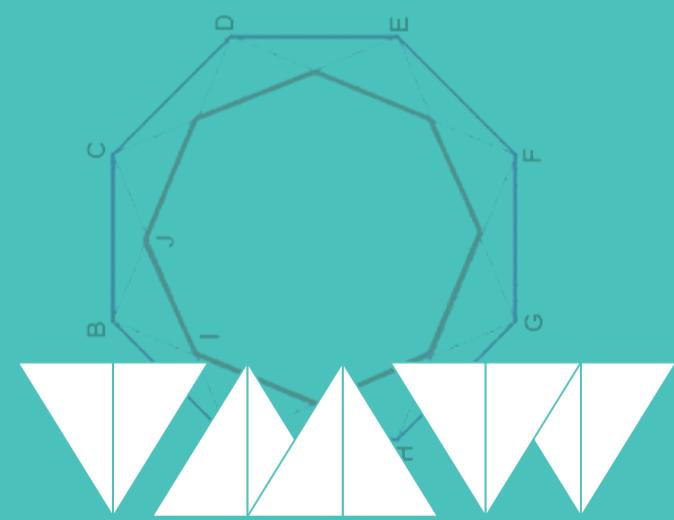


DISCOVER DESIGN & MATHEMATICS



Veras Mathematic World '17

Once in a while there is
a person who dedicates
a lifetime to research and
education, and inspires
the rest of us to embark
on a personal journey
of lifelong learning...

or $x^2 - px - q = 0$, which positive solution is

$$x = \frac{p + \sqrt{p^2 + 4q}}{2}$$

This means that

$$\lim_{n \rightarrow \infty} G(n+1) = \frac{p + \sqrt{p^2 + 4q}}{2} \quad (1.4)$$

2. The Metallic Means Family (MMF)
Then we define

Definition: The Metallic Means Family is the set of positive eigenvalues of the matrix equation

$$\begin{pmatrix} p & 1 \\ q & 1 \end{pmatrix}^n = \begin{pmatrix} p^n & 1 \\ q^n & 1 \end{pmatrix} \quad (2.1)$$

Consequently, all the members of the MMF are quadratic irrational numbers that are the positive solutions of equations of the type

$$x^2 - px - q = 0$$

Let us begin considering the case where $q = 1$ in equation (2.2):

$$x^2 - px - 1 = 0$$

If $p = 1$, we have $x^2 = x + 1$ that can be written

$$(x-1)^2 = 1$$

Replacing iteratively the value of x , we arrive to the following infinite continued fraction expansion

$$\frac{1}{x-1} = [1; 1, 1, 1, \dots] \quad (2.2)$$

a purely periodic continued fraction that defines the well known Golden Mean

volume 3 (2010), number 1

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$$\begin{aligned} 4C &= \sqrt{4B^2 + BC^2} = 2 \cdot AB \cdot BC \cdot \cos 135^\circ \\ \frac{AB}{AC} &= \frac{AI}{AI} \Rightarrow AI = \frac{1}{\sqrt{2+\sqrt{2}}} \\ U &= AC - 2AI = \sqrt{2-\sqrt{2}} \\ \frac{AB}{U} &= \frac{1}{\sqrt{2-\sqrt{2}}} = c \equiv \text{cordovan } n^0 \end{aligned}$$



Aplimat – Journal of Applied Mathematics

If $p = 2$, we get the Silver Mean

$$\sigma_{4p} = 2 + \frac{1}{2 + \frac{1}{2 + \frac{1}{2 + \dots}}} = 1 + \sqrt{2} = [2]$$

Analogously, if $p = 3$ we get the Bronze Mean

$$\sigma_{6p} = 3 + \frac{1}{3 + \frac{1}{3 + \frac{1}{3 + \dots}}} = 3 + \sqrt{3} = [3]$$

For $p = 4$, the Metallic Mean is

a striking result that is related to the famous periodic expansion of odd powers of the Golden Mean. As is easily proved, the following Metallic Means are

$$\begin{aligned} \sigma_2 &= \frac{3 + \sqrt{5}}{2} = [1; 2] \\ \sigma_4 &= 4 + \sqrt{2} = [3; 1, 1] \\ \sigma_6 &= 5 + \sqrt{5} = [3; 2, 1, 1] \\ \sigma_8 &= 8 + \sqrt{17} = [3; 2, 2, 1, 1] \\ \sigma_{10} &= 13 + \sqrt{26} = [3; 2, 2, 2, 1, 1] \end{aligned}$$

and so on. All the members of the MMF are the positive roots of the quadratic equation (2.3) are of the form $[n]$, a purely periodic continued fraction expansion.

Instead, if we consider the quadratic equation

$$x^2 - x - q = 0$$

for $q = 1$ we get again the Golden Mean. If $q = 2$, we get the Copper Mean

$$x^2 - x - 2 = 0$$

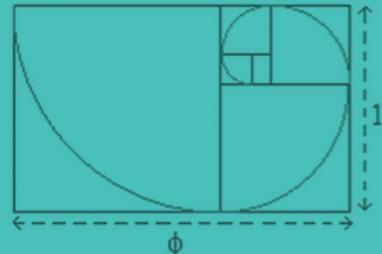
If $q = 3$ we get the Nickel Mean

$$x^2 - x - 3 = 0$$

another periodic continued expansion that is not purely periodic. In a similar way, we obtain

$$\begin{aligned} \sigma_2' &= [2; 1, 1, 3], \sigma_4' = [2; 1, 1, 1, 1], \sigma_6' = [3; 2, 1, 2, 5], \\ \sigma_8' &= [3; 1, 1, 5], \sigma_{10}' = [3; 1, 2, 2, 1, 2], \sigma_{12}' = [3; 1, 2, 1, 4], \sigma_{14}' = [4; 1, 0] \end{aligned}$$

JOIN A GLOBAL MOVEMENT



$$\frac{\pi}{2} + \frac{\pi}{2}(\phi - 1) + \frac{\pi}{2}(\phi - 1)^2 + \dots = \frac{\pi}{2}(1 + \phi)$$

$$AD = 0 = 1 - \sqrt{2}$$

$$AK = BC = 1$$

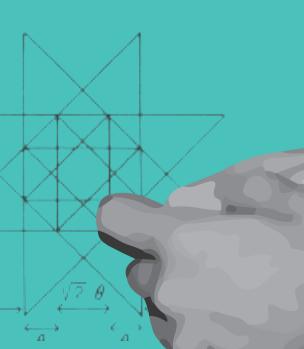
$$KL = AD = 1.418 = 1 + \sqrt{2} - 2 = \sqrt{2} - 1$$

$$\frac{AB}{KL} = \frac{2}{\sqrt{2}-1} = \sqrt{2} + 1 = \Theta$$

$$\Omega = \sqrt{2} e^{\frac{\pi i}{4}}$$



JOIN A GLOBAL MOVEMENT



WHAT

Organization of a global movement with thousands of students, scientists, and followers of the mathematics and design great-grandmother, in the house which enabled her to develop and produce a paradigm shift that some consider fundamental in the twentieth century.

For the tribute a presentation will be held on November 23rd 2017 during a continuous academic day in the Central Courtyard of the Faculty of Architecture, Design and Urbanism of the University of Buenos Aires with projections of the digital result of the call. The initiative's aim is to spread the research developed by Dr. Spinadel in FADU-UBA and around the world in order to achieve new synergies between mathematics and design. Those who wish, additionally to their digital presentation, can also make a presentation in person.

WHEN

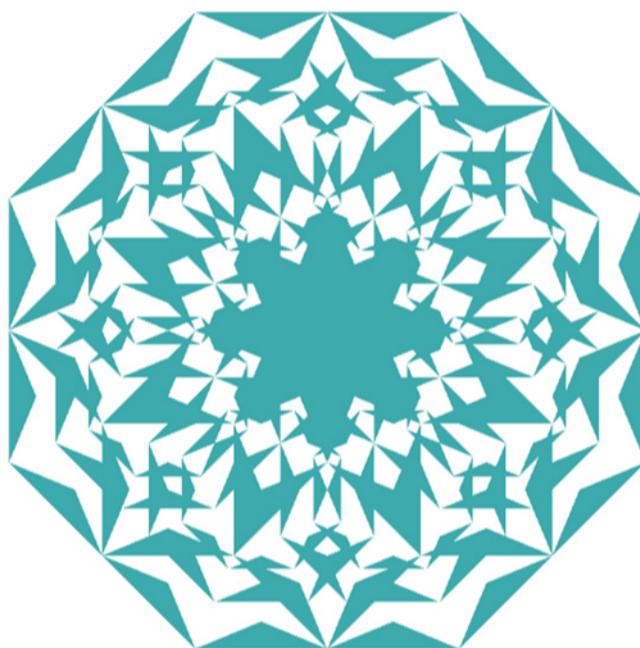
Schedule:

Participation Registration: from May 6th 2017

Participation Confirmation: until June 30th 2017

Material Submission Deadline: August 22nd 2017

Presentation: November 23rd 2017



HOW

In PechaKucha adapted format with the aim of being able to visualize the impact of Dr. Spinadel's trajectory. The presentation will consist of:

An **Image** that communicates the imprint that the relationship between Mathematics and Design, studied and developed by Dr. Spinadel, has had in your own production.

A **Sentence** that resumes the concerns and reflections raised by your interaction with Dr. Spinadel - in one or more of her roles as teacher, scientist or person.

A **Selfie-Clip** that explains your enthusiasm for Mathematics and Design unveiled over the years after meeting Dr. Spinadel

Personal **Presentation** of the importance that mathematics and design have had in your trajectory after being inspired by Dr. Spinadel (optional)

Publication: All submitted presentations will be published online (one by one, each day) starting on December 1st 2017

Language: Spanish and English

OPEN CALL

The only prerequisite of the proposals is that they fully meet the described requirements. The presentation's order will be based on the time of person's registration.

A project of the Initiative Legacy of Dr. Vera Martha Winitzky de Spinadel and the Faculty of Architecture, Design and Urbanism of the University of Buenos Aires.

JOIN the tribute to Professor Vera Martha Winitzky de Spinadel (1929-2017)

WHEN: REGISTER FROM 06.05. - 30.06.2017 | **HOW:** INTERNATIONAL OPEN CALL at verasmathematicworld.org