

## PRINCIPLE OF YIN-YANG COMPLEMENTARITY IN AEROSPACE SCIENCES

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**Rezumat.** *Lucrarea constituie un domeniu transdisciplinar, în care se îmbină, în mod armonios, principiul complementarității introdus de marele fizician Niels Bohr în mecanica cuantică, filosofia străveche chineză, având ca esență „Diagrama Unității Supreme”. Afirmațiile sunt justificate prin argumente de natură religioasă, cuantică și geometrică. Sunt definite conceptele de dimensiune, sistem de coordonate și noțiunile specifice ca: perpendicular în geometrie, orthogonal în analiza matematică, corect în domeniul dreptului și orto în religie. Este prezentată, în continuare, o clasificare a principiului complementarității, prin cele două forme de manifestare, armonică și nearmonică. Ca aplicații, se apelează la cunoscutele domenii ale mecanicii fluidelor, hidro sau aerodinamică. Plecând de la noțiunile de sursă, vârtej și mișcare paralelă, prin combinații diadice și triadice, se ajunge, în final la o explicație științifică a conceptului filosofic de Yin și Yang, care stă la baza filosofiei chineze.*

**Abstract.** *This paper is a transdisciplinary field that combines, harmoniously, the principle of complementarity introduced by the great physicist Niels Bohr in quantum mechanics and the ancient Chinese philosophy, whose essence is "Diagram of the Supreme Ultimate". The allegations are supported by religious, quantum and geometry arguments. Defined concepts of di-mension, coordinate system and specific concepts as: perpendicular in geometry, orthogonal in mathematical analysis, correct in law and ortho in religion. It is shown, further, classification for principle of complementarity, by the two manifestations, harmonic and non-harmonic. As applications, we use the known areas of fluid mechanics, hydro and aerodynamics. Based on the concepts of source, vortex and parallel motion through dyadic and triadic combinations, arriving, finally at a scientific explanation of the philosophical concept of Yin and Yang, underlying Chinese philosophy.*

**Keywords:** complementary, quantum mechanics, philosophy, arguments

### 1. In the beginning was the Word

In the dictionary, the word complementary can mean that complements;

- Two angles whose sum makes  $90^\circ$ ;
- Two colors, of the light spectrum, one primary and one derived, which, by superposition, give white color, the light.

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Perhaps the most suggestive meaning of the word complementary is geometric nature, which can be extended to

- Directions (straight lines) forming  $90^\circ$ , so perpendicular straight line;
- Coordinated, two axes arranged so as to make it  $90^\circ$ .

Why cannot speak of orthogonal polynomials, in algebra; orthogonal functions in trigonometry and analysis; orthonormal functions in functional analysis. And the examples could go on forever, in every area of our lives.

In its cosmic meaning, native, DAO is indefinable ultimate reality. Father of Daoism (doctrine of DAO) is LAO TSE, and to him is assigned writing to a book of aphorisms, known as DAO TE CHING, which can be translated as "The Classic/Canon of the Way/Path and the Power/Virtue".

The essence of Daoism is found in the first two verses of chapter 42 of the book mentioned, stating „The DAO gives birth to ONE, ONE gives birth to TWO, TWO gives birth to THREE, THREE gives birth to the ten thousand things”... „The ten thousand things have their backs to YIN and embrace stand facing YANG. They achieve harmony by combining these forces”.

What could be more clearly said, which is that, things of nature and man, DAO's creations, are combinations of YIN and YANG.

## **2. Principle of complementarity in quantum mechanics**

What finally clarify the concept of complementarity, are the great discoveries that physicists discovering, at the beginning of the twentieth century.

- Max Planck introduces the concept of quanta;
- Albert Einstein, in 1905 developed the quantum theory of light, based on photon. By this, actuality brings the dual nature of bodies and the light wave;
- The development of quantum mechanics in two distinct ways: of the wave mechanics and of the matrix mechanics formulation of quantum mechanics approached by Werner Heisenberg.

Heisenberg, in 1927, discovered one of the fundamental principles of quantum physics, the uncertainty principle, expressed by famous relationships, applied to the conjugated physical quantities

- Coordinate - momentum;
- Energy - time, in a certain state of their own.

It stated unable to determine with precision, while, the position and velocity of a particle. Based on this principle, Niels Bohr, in 1927, conceived the principle of complementarity.

According to this principle, the nature has two complementary sides that are not visible at once, simultaneously. Therefore cannot be treated unitary, wave and corpuscular properties of an object, since they can only be separated. These properties are complementary, so as, from their entirety, we can know the whole object. Based on this fact, Niels Bohr gives, the shortest and striking forms, the famous principle of complementarity, which we can be read on the family crest **"CONTRARIA SUNT COMPLEMENTA"**.

### 3. Complementarity in Chinese philosophy vision

**"Diagram of the Supreme Ultimate"** obtained by symmetrical arrangement of YIN, dark and YANG, bright, but symmetry is not static, it is one rotary, suggesting continuous motion and cyclical.

„Life," said the Chinese philosopher CHUANG TSE „is a harmonious blending of Yin and Yang, the balance between them, by CHI vital energy circulation”.

The pair of complementary of the YIN and YANG is best expressed in the idea of cyclical motion of DAO.

At first DAO means "PATH" or becoming universe, order of the world. Later philosophers give another name for normal behavior. In its cosmic meaning, origin, Dao is the ultimate reality undefinable.

### 4. Arguments in favor of complementarity

#### 4.1. Arguments of the divine nature

Philosophically speaking, transcendent is what rises above the level of a defined area. Transcendent reality is beyond our knowledge.

When we speak of God's **transcendence** it evokes a God

- Creator;
- distinct from his creation.

When we speak we refer to a **immanent** God

- present in the world;
- present in ourselves;
- knowable.

Transcendence is the opposite of immanence. Thus speaking, transcendence means **RISE AND MERGE INTO GOD** and the immanence means **OMNIPRESENT and GOD'S ESSENCE**.

Already, on knowing God, we are faced with two options

- one **TRANSCENDENT**, state potential;
- other **IMMANENT** manifestation, component of the Cosmos, moving, horizontally.

## 4.2. Arguments of quantum physics

According to Heisenberg's uncertainty principle, in the universe of elementary particles, with mass of the order of  $10^{-30}$  kg and speeds comparable to the speed of light, if  $\Delta x$  and  $\Delta V_x$  are principles that can measure the position  $x$  and  $V_x$ , then, in accordance with the uncertainty

$$\Delta x \cdot \Delta V_x \cong \frac{h}{m}, \quad (1)$$

where

- $h$  is Planck's constant, a fundamental constant of nature;
- $m$  is the mass of the particle.

It is obvious that if  $\Delta V_x$  it is very small, it means that you determine  $V_x$ , very accurate, then  $\Delta x$  it must be relatively large, which means that we not know  $x$  precisely.

Heisenberg's discovery would have an unexpected resonance in the world of physics, in general, when, in 1927, physicist Niels Bohr has defined and developed a theory of measure incommensurability, a principle that would revolutionize scientific life, the principle of complementarity.

According to its, nature has two complementary sides that, are not visible at once, but simultaneously.

## 4.3. Geometric arguments and perspective of coordinate systems

Etymologically speaking, orthogonal means right angle or normal angle. Right angle is one of the great discoveries in the universe, probably related to the measurement and surface harmony in ancient Egypt. Later it was shown that, given two sides of a triangle, it has the maximum area, if rectangular, as, of all plane curves, closed and the same length, the largest area has the circle.

Not coincidentally right angle and circle will be fundamental geometric elements in the emergence, development and evolution of geometry.

It should be recalled here that, a happy combination between the right angle, the Pythagorean Theorem and the golden section, as an expression of the law of organic growth, led to the discovery of natural spiral by Fibonacci.

Golden section and the Pythagorean Theorem, in J. Kepller conception, are the two treasures of geometry.

In fact, the Pythagorean theorem can be seen, in the light of the importance of the right angle, so "if in a triangle the sum of the squares of two sides equals the square of the square of the hypotenuse (the side opposite the right angle), triangle has a right angle, so is rectangular."

The proof given by Pythagoras of the 500 demonstrations, using the areas of the squares constructed to the catheters and hypotenuse represents an application of the law of continuity of information flow, knowing that information travels at the speed of light, the amount of information is proportional to the surface crossed.

It should be noted that, the information corresponding to the catheter are complementary, catheter directions being orthogonal, in terms of geometrically, orthogonal.

Basically, the global information decomposes in two perpendicular directions, the components having distinct natures or sources.

In connection with the concept of coordinate system, is accurate that, in general, the sizes measured, on the horizontal and vertical axis, are complementary, axes making an angle of  $90^\circ$  and, from here, the notion of system of co-ordinates, sizes ordered on perpendicular axes.

However, each axis corresponds to the idea of dimension, probably prefix "di" refers to the two-way to scroll a line and, can be

- top-down;
- left and right;
- forward and backward.

Using these observations, René Descartes, get to turn any geometric problem into one algebraic. Thus, given two orthogonal axes  $Ox$  and  $Oy$ , any point  $M$ , from their plane, corresponds a pair of two numbers, point coordinates and vice versa, to a pair of points by two numbers corresponds a well-defined point in plan.

## 5. Typology of complementarity

### 5.1. Inharmonious complementarity

W. Leibniz see, in his binary arithmetic, image of creation. To him it seemed that

- unity is God

and

- zero, the void, the Supreme Being created all beings from nothing, exactly the same as unity and zero express all numbers of the numbering system, "said Laplace.

We can accept that, the natural numbers are given along with the two fundamental operations

- addition;
- multiplication.

That is why, in relation to each operation, can be a classification if the complementary relationship.

So,

- a) When the two principles are the same nature is defined LINEAR COMPLEMENTARITY (LC);
- b) When the two principles differ, it can specify HYPERBOLIC COMPLEMENTARITY (HC)
- c) CIRCULAR COMPLEMENTARITY (CC).

Considering that the principles can be expressed by two numbers  $x$  and  $y$ , then we can write relations

- $1 = x + y$ , for LC; and
- $1 = x \cdot y$ , for HC;
- $1 = \sin^2 \alpha + \cos^2 \alpha$ , for CC.

If  $x$  and  $y$  are defined geometrical as lengths, then we can define

- perimeter complementarity (CP);
- areal complementarity (CA).

#### a) LINEAR COMPLEMENTARITY

Examples:

- Mechanical, kinetic and potential energy sum is a constant

$$E_c + E_p = ct.$$

- Reliability theory, reliability and unreliability function sum

$$R(t) + F(t) = 1.$$

#### b) HYPERBOLIC COMPLEMENTARITY

Examples

- Quantum physics, the uncertainty principle

$$\Delta x \cdot \Delta V_x = ct.$$

- Theory of relativity, the space,  $s$ , and time,  $t$ , is a constant

$$s \cdot t = ct.$$

- The science of quality, product quality,  $C$ , quantity,  $Q$ , is a constant

$$C \cdot Q = ct.$$

### 5.2. Harmonic complementarity

Harmonic complementarity is a particularly harmonious relationship between the two constitutive principles, one representing the information, state, and the second constituting action, movement. Harmonic term, literally, can be interpreted by

- matching;
- consistent;
- agreement between the parts of a whole.

Much more important are, however, currently, mathematical connotations of harmony, about the harmonic functions.

It is known that, harmonics functions of two independent variables as the simplest case, can be found in the theory of complex variable functions.

It is known that an analytic function,

$$f(z) = \varphi(x, y) + i\psi(x, y), \quad f : E \rightarrow C \tag{2}$$

and variable

$$z = x + iy, \quad \in E \tag{3}$$

is homogeneous if it satisfies the homogeneous function Cauchy–Riemann

$$\frac{\partial \varphi}{\partial x} - \frac{\partial \psi}{\partial y} = 0 \tag{4}$$

and

$$\frac{\partial \varphi}{\partial y} + \frac{\partial \psi}{\partial x} = 0. \tag{5}$$

If function  $f(z)$  is holomorphic or analytic (monogenic, differentiable, at each point  $z \in A, A \in E$ ) and

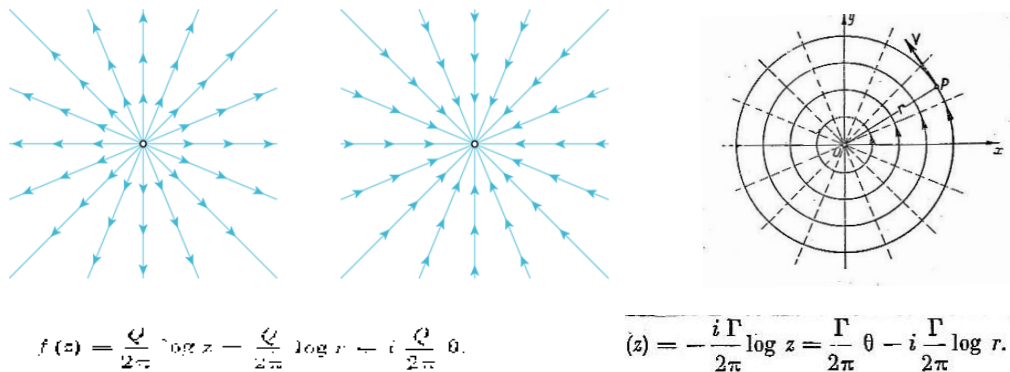
$$\Delta \varphi = \frac{\partial^2 \varphi}{\partial x^2} + \frac{\partial^2 \varphi}{\partial y^2} = 0 \tag{6}$$

respectively

$$\Delta \psi = \frac{\partial^2 \psi}{\partial x^2} + \frac{\partial^2 \psi}{\partial y^2} = 0, \tag{7}$$

where  $\Delta$  is called the Laplacian differential operator, the  $\varphi$  and  $\psi$  functions verified Laplace equation, in all dimensions D points, in which D is open on  $R^2$ , then they are harmonics.

A couple of functions  $\varphi(x, y), \psi(x, y)$  harmonic in a domain D, satisfying the Cauchy-Riemann conditions, is called pair of harmonic conjugate.

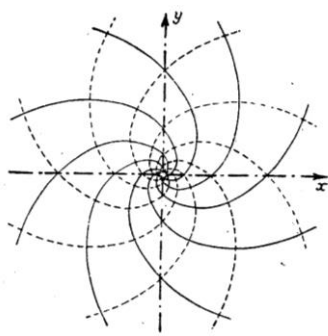


**Fig. 1.** The structure of the characteristics lines and complex potential.  
Source&Vortex.

6. Complementary imaging in fluid mechanics

6.1. Monadic structure

6.2. Dyadic complementary structure (cosmic)



$$f(z) = \frac{Q - i\Gamma}{2\pi} \log z = \frac{Q}{2\pi} \log r + \frac{\Gamma}{2\pi} \theta + i \left( \frac{Q}{2\pi} \theta - \frac{\Gamma}{2\pi} \log r \right)$$

Liniile de curent sînt spiralele logaritmice

$$r = ke^{\frac{Q}{\Gamma} \theta}$$

iar liniile echipotențiale sînt spirale logaritmice

$$r = ce^{-\frac{\Gamma}{Q} \theta}$$

îndreptate în sens invers și ortogonale cu primele

Fig. 2. The structure of fundamental lines.  
Source+Vortex.

6.3. Dyadic structure-rotation

$$f(z) = -\frac{i\Gamma}{2\pi} \log \frac{z-a}{z+a} = \frac{\Gamma}{2\pi} (\theta_1 - \theta_2) - \frac{i\Gamma}{2\pi} \log \frac{r_1}{r_2}$$

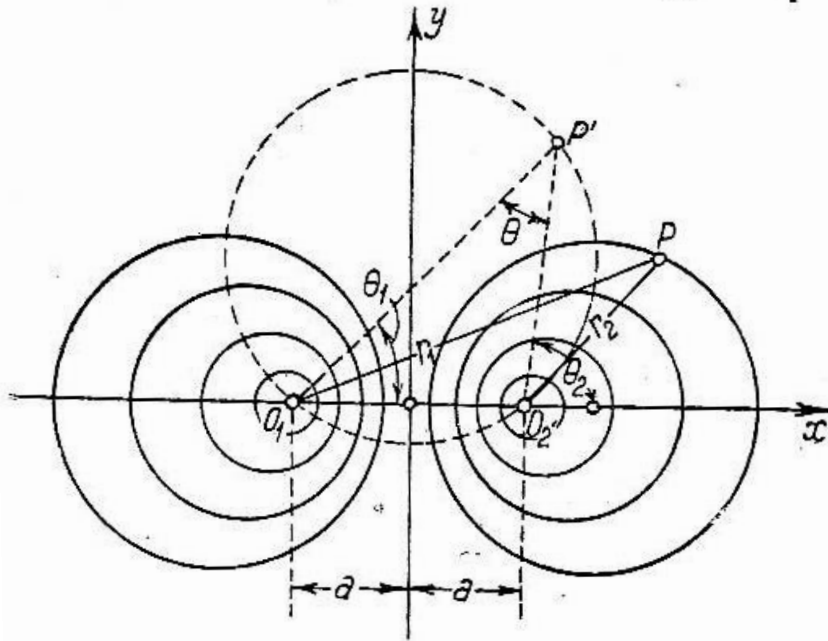


Fig. 3. The structure of fundamental lines and complex potential for 2 complementary vortices.



6.4. Transformation conform with reality

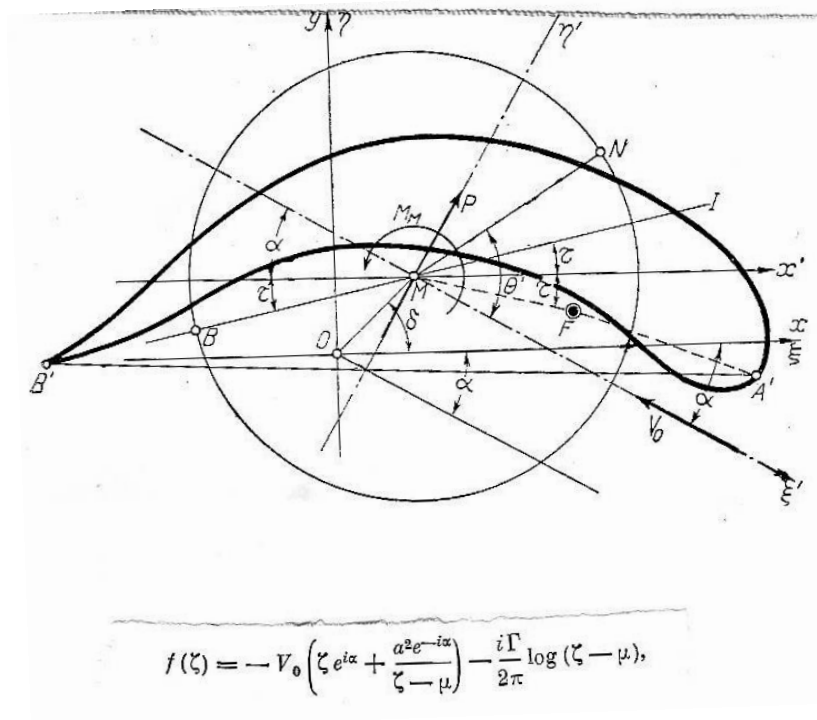


Fig. 4. Potential flow around an airfoil.

6.5. Structures on circle

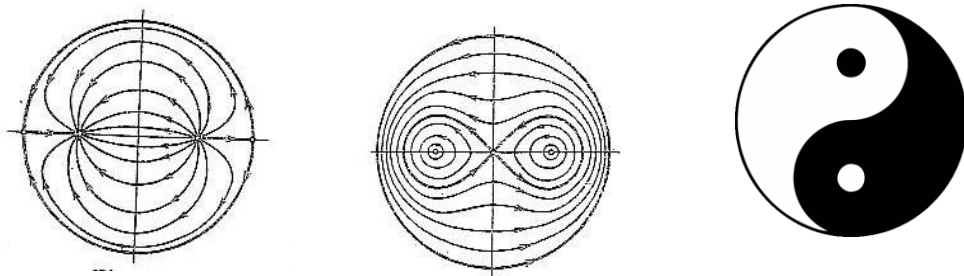


Fig. 5. Structures of characteristic lines for of circular flow.

a. 2 complementary sources; b. 2 additional vortices/ c. Diagram of the Supreme Ultimate.

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