Introduction to Santilli iso-numbers

Christian Corda

Citation: AIP Conference Proceedings **1479**, 1013 (2012); doi: 10.1063/1.4756316
View online: http://dx.doi.org/10.1063/1.4756316
View Table of Contents: http://scitation.aip.org/content/aip/proceeding/aipcp/1479?ver=pdfcov
Published by the AIP Publishing

Introduction to Santilli Iso-Numbers

Christian Corda[a]

[a]Institute for Theoretical Physics and Advanced Mathematics (IFM) Einstein-Galilei, Via Santa Gonda, 14 - 59100 Prato, Italy.

Abstract. Santilli iso-numbers, which are the mathematical basis of Hadronic Mechanics, are introduced and reviewed at a semi popular level.

Keywords: Iso-numbers, Hadronic Mechanics.
PACS: 02.10.De

All quantitative sciences require a mathematical treatment that produces numerical values verifiable by experiments. Hence, the basis of quantitative sciences is given by the numbers as real, complex and quaternion. Scientific theories are derived by those numbers through processes of complementarity.

A definition of "numbers" required for applications is that of a set (here indicated by the symbol N) of elements generally indicated with letters such as n = a, b, c, ... (representing precisely the real, complex or quaternion numbers) equipped with a multiplication a × b and a sum a + b occurring the following axioms of numeric fields (see, for example, [1]):

1) The set N admits an element 1, called "multiplicative unit", such that 1×a=a × 1= a for all elements of N;

2) The set N admits an element 0, called "additive unit", such that 0 + a = a +0 = 0 for all elements of N;

3) The set N is "closed" under multiplication and sum, i.e., all the multiplications a × b and the sums a + b between elements a and b produce all possible elements of N;

4) The multiplication and addition are associative, i.e. (a × b) × c = a × (b × c) and (a + b) + c = a + (b + c);

5) The combination of multiplications and sums is distributive, i.e. (a + b) × c = a× c +b × c, a × (b + c) = a × b + a × c.

Given the fundamental nature of the numbers for all quantitative sciences, one of central problems of pure mathematics, as part of number theory, has been the classification of all numbers, i.e. the identification of all sets occurring axioms of numeric fields. Some of the most famous mathematicians of history, such as Cayley, Hamilton and many others, participated in the classification of numbers.

The result of these studies, which are deemed to be accurate up to recent times, is that all numbers are available, i.e. all possible sets of numeric fields are given by: real numbers, for example n = 2; complex numbers, for example n = 2 + i × 3, where i is the imaginary unit; and quaternion numbers, for example $n = 2 + i_1 \times 3 + i_2 \times 7 + i_3 \times 21$, where the quantities i_1, i_2 , i_3, are given by the so-called units represented by quaternion matrices. The so-called ottonions are not "numbers" as defined above because they violate the axiom of associativity of multiplication and therefore are not applicable to experimental measurements for various technical reasons.

The scientific advances allowed by the above numbers are now part of history.

In fact, the real numbers are and remain the basis of all quantitative classical Newtonian sciences, and are still applied, for example, to the trajectories of interplanetary travel. Complex numbers have led to the creation and use of Hilbert spaces and related development of quantum mechanics and quantum chemistry with applications by nuclear energy to new chemical compounds. Quaternion numbers have allowed basic studies on electromagnetic fields, for example, by the Hamiltonian quaternion representation of Maxwell Equations in the field of electrodynamics.

Santilli [2, 3] has found a new set of numbers occurring the axioms of number fields. He has shown that the axioms of number fields admit the following five classes of different realizations:

I) The axioms of the field have in fact been verified by conventional real, complex and quaternion numbers;

II) The axioms of field do not require that the unit multiplicative must necessarily be the number 1. Indeed, it can be an arbitrary amount, provided that:

A) The new unit 1 is positive (to admit the inverse 1 = 1 / t >0);

B) The conventional numbers n are redefined in the form n ≡ n × 1;

Numerical Analysis and Applied Mathematics ICNAAM 2012
AIP Conf. Proc. 1479, 1013-1015 (2012); doi: 10.1063/1.4756316

C) The multiplication a×b is changed in the form a×b = a× t×b = a×(1/1) × b which is always associative;

D) The additive unit and its sum is kept unchanged, i.e. 0=0, a + b= a+b.

Given a number N with n elements, all of its amendments (called *liftings*) in its previous form, labelled here with N, with elements n = n × 1, occur all the axioms of number fields and thus are "numbers" usable in quantitative sciences. For example, the axiom of multiplicative units is verified by the expression 1 × a = 1 ×(1/1)×a =a ×(1/1)× 1 valid for all elements of the new set N. This discovery leads to the identification of new numbers called isotopic Santillian numbers (see, for example [5]) where the term *isotopic* is understood in the Greek sense of "same topology", and preservation of the original axioms, in which case the new unit 1 is called Santillian iso-unit, the new multiplication a×b is called Santillian iso-multiplication, etc. This first discovery leads to the identification and use of new numbers [2,3,4]: the iso-reals, iso-complexes and iso-quaternion which are sketched in this paper. Note that in this case 2×3 is generally different from 6 because the result of the multiplication depends on the value assumed by the multiplicative unit.

III) In addition to II, the axioms of field do not necessarily require that the iso-multiplication acts both right and left giving the same results [2], because the axioms of field are also tested when all the multiplications (and sums) are restricted to act to right $a > b$, i.e. a multiplies $<b$ at right, or left $a <b$, i.e. $<b$ multiplies a at left, and the same is assumed for the sum. In that case, restricting all operations to act on the right or left, the same isotopic set N allows to construct two different sets $N>$ and $< N$ with a corresponding unit $1 >$ and < 1 and multiplications compatible with the respective units. It follows that transactions with the same elements can give different results because, generally, $a > b \neq a <b$ since, in general, the units are different $1 > \neq < 1$.

This issue implies the existence of a second class of numbers, called *geno-topic*, where the prefix "geno" is used in the Greek sense of "inducing" new structures, in which case the new units $1 >$ and < 1 are called the geno-multiplication on the right and left, etc. In this manner, the new geno-real, geno-complex and geno-quaternion numbers enable applications to irreversible systems that motivated their discovery. It should be noted that in this case $2> 3$ and $2 <3$ not only do not give, in general, the result 6, but they give different results dependent on the multiplicative units that are taken for the operations to the right and left.

IV) In addition to III, the multiplicative unit does not necessarily have a unique value, because it can have a set of values, such as $1> = \{2, 4/5, 7, ...\}$, provided that the set is ordered and defined as applicable or to the right or left. This discovery leads to the construction of additional new numbers known as hyper-Santillian numbers (not to be confused with so-called hyper-mathematical structures that typically have no units), including hyper-real, hyper-complex and hyper-quaternion numbers, that enable applications to biology that also motivated the discovery of hyper-numbers . It should be noted that in this case $2> 3$ and $2 <3$ not only do not give, in general, the result 6, but result in two sets of values generally different from each other.

V) In addition to II, III and IV, the multiplicative unit must not necessarily be positive because it can very well have negative values but not zero, for example, assuming the value -1 [2]. This leads to the discovery of a new class of numbers called iso-dual Santillian numbers, where the term "iso-dual" expresses a duality in units from positive to negative ones with the maintenance of the axioms of the original field. This leads to the identification of new classes of conventional iso-dual numbers, iso-topic iso-dual numbers, geno-topic iso-dual numbers, and hyper-structural iso-dual numbers [4], with applications for antimatter for which the iso-dual numbers were discovered.

In summary, we get eleven new numbers of classes, each class is applicable to the real, complex and quaternions numbers, and each of these applications have an infinite number of possible units. These new numbers are given by: the iso-topic numbers, geno-topics to the right and left, right and left hyper-structural, iso-dual conventional, iso-dual iso-topic, iso-dual geno-topic to the right and left and hyper-structural iso-dual to the right and left. Note that from a mathematical point of view of abstract, one class of Santillian numbers, the hyper-structural one, can be defined as allowing all the other numbers, but that the classification I, II, III, IV and V is recommended to avoid confusion in applications, not in mathematics, but in physics and chemistry.

In this paper we can only give an idea of the new isotopic Santillian numbers, with the understanding that a technical study can only be done by the original publications [2,3,4,5].

The simplest realization of the iso-topic numbers is given by the conventional real numbers N, in which the unit is any positive real number other than 1 and 0, while the sum and the correspondent additive unit remain unchanged in order to do not violate the axioms of numeric fields. Let us consider the Santillian iso-unit 1 =1/5 with inverse value t =5. In that case 2×3=2 × (1/ 1 × 3 = 2 × 5 × 3) = 30. It follows that the traditional statement according to which "2 multiplied by 3 gives 6" is not, in general, mathematically correct, because the mathematically correct claim is the following: "2 × 3 = 6 with the assumption that the unit has the multiplicative value 1 and the multiplication is the conventional one".

A second class of Santillian iso-numbers, the one which is more used in physics and chemistry, is found outside the set of conventional numbers. For example, assuming a function, or a matrix, or an integral like iso-unit 1. In these cases the real numbers N must be multiplied by the iso-unit to be iso-numbers, $n = n \times 1$ as a necessary condition to verify the axioms of the fields. Hence, all the operations involving the multiplication must be generalized. For example, the conventional fraction 2/3 becomes $2 / 3 = (2/3) \times 1$; the square root becomes $n^{(1/2)} = n^{1/2} \times 1^{1/2}$ which implies $[n^{(1/2)}]^2 = n^{(1/2)} \times n^{(1/2)} = n$; etc.

Santilli iso-numbers admit various applications in science. The first application of the new iso-topic numbers is in cryptology through the lifting of cryptograms in the so-called iso-cryptograms. As it is known, there is a mathematical theorem according to which any cryptogram can be solved in a finite period of time. The iso-cryptograms, however, are based on an arbitrary unit which can assume an infinite number of values. It follows that the Santillian iso-cryptograms require a huge amount of time, if not infinite, for their resolution, for which they are much safer than conventional cryptograms. Moreover, the iso-unit can be changed automatically and continuously, thus preventing any resolution. It seems that banks are already using iso-cryptograms with an automatic periodically change of the iso-units, achieving absolute security because, while the "hackers" are looking for the solution, the iso-cryptogram is changed. Remember that once the greatest concern of the bankers was to change the cryptogram every day. This nagging problem has been solved by Santillian cryptograms. Of course the bank's (and credit cards') safe is covered by strict secrecy that is not possible to obtain additional information, even if an expert cryptographer can easily "lifting" cryptograms in Santillian isotopic conventional form.

The iso-numbers allow a generalization of quantum mechanics known under the name of hadronic mechanics, i.e. mechanics built specifically for the "hadrons" (strongly interacting particles) [4] which will be the object of Symposium n. 50 at the 2012 ICNAAM Conference (2012 Seminar Course on Hadronic Mechanics) [6,7]. In fact, quantum mechanics is certainly correct for the physical systems for which it was designed, developed and experimentally verified. Such systems consist essentially in point particles and electromagnetic waves which move in a vacuum, and they comprise the structure of the hydrogen atom, particle accelerators, crystals, and many other physical systems. Nevertheless, quantum mechanics, even if there still remains valid in first approximation, has been shown to have some clear limitations when studying elementary particles at mutual distances equal to or less than their size. In [4d] many specific cases where the lack of exact validity of quantum mechanics has proved to be beyond scientific doubt have been discussed. In particular, the hadronic mechanics has shown that quantum mechanics remains completely inapplicable to the synthesis of the neutron [4d] because the mass of the neutron is greater than the sum of the masses of the proton and electron, in which case the quantum equations become inconsistent (in fact they are congruent only for bound states such as nuclei, atoms and molecules for which the energy of the final state is smaller than the sum of that of the constituents, so resulting in "mass defect" that is the basis of nuclear energy). With the new math, hadronic mechanics has solved this problem by reaching the first performance numerically exact and time invariant at both non-relativistic and relativistic levels of "all" the characteristics of the neutron in its synthesis from the electron and proton (see [4d]). Numerically exact results have been achieved in other cases in which quantum mechanics results not valid.

For further details of the fascinating Santilli iso-numbers we recommend refs. [1,2,3,4,5] and the 2012 Seminar Course on Hadronic Mechanics at the 2012 ICNAAM Conference [6,7].

ACKNOWLEDGMENTS

The Ruggero Maria Santilli Foundation has to be thanked for financing this review paper.

REFERENCES

1. H. Davenport , "Aritmetica superiore. Un'introduzione alla teoria dei numeri" , Bologna: Zanichelli, 1994 .
2. R. M. Santilli, *Alg. Gr. Geom.* **10**, 273-321 (1993) .
3. R. M. Santilli, Circolo matematico di Palermo, (Special Issue on Santilli Isotopies) Supp.,Vol. 42 (1996).
4. R. M. Santilli, "Hadronic Mathematics, Physics and Chemistry", Vols. I [4a], II [4b], III [4c], IV [4d] and V [4e] , New York : International Academic Press , also in http://www.i-b-r.org/Hadronic-Mechanics.htm .
5. C. X. Jiang , "Fundaments of the Theory of santillian Numbers", International Academic Press, America-Europe-Asia (2002) , also in http://www.i-b-r.org/docs/jiang.pdf .
6. http://www.icnaam.org/Sessions_Minisymposia.htm.
7. http://www.santilli-foundation.org/HM-course-schedule-2012.php.