TJMM
6 (2014), No. 1, 09-11

MATHEMATICAL MODELS REGARDING THE BASIC INFORMATIVE ELEMENTS FOR THE CLASSICAL COMPUTERS AND THE QUANTUM COMPUTERS RESPECTIVELY

MALVINA BAICA AND MIRCEA CARDU

Abstract. In this paper we use the results obtained in a previous paper [1] regarding the pairs of the DUAL roots (+1 OR −1) and respectively BIPOLAR roots (+1 AND −1) of a couple of equations "seen in the mirror" ($y^2 \pm 1 = 0$) and with the help of a mathematical artifice we arrive to the basic informative elements characteristic to the Classical Computers (1 OR 0) and respectively to the Quantum Computers (1 AND 0). In this way we also prove that the two categories of the basic informative elements have a joint origin in the couple of the equations mentioned above.

1. Introduction

We recall that in a previous paper [1] starting from the equations

$$y^2 \pm 1 = 0 \tag{1}$$

we analyzed the equations which resulted from the application of every algebraic sign separately (+ OR -) namely

a) $h^2 - 1 = 0$ (2)

which has the roots

$$h_1 = +1 \text{ OR } h_2 = -1 \tag{3}$$

b) $i^2 + 1 = 0$ (4)

which has the imaginary root

$$i = \sqrt{-1} \tag{5}$$

c) $j^2 + 1 = 0$ (6)

which has the roots

$$j_1 = +1 \text{ AND } j_2 = -1 \tag{7}$$

We specify that for c) case we admitted the nonconventional hypotheses that the negative number (−1) has quadratic equal roots with absolute value |1|, but different algebraic signs such as + and −. We mention that in this case these two roots are valid only when they are considered together and we accentuated this fact by introducing in the relations (7) of the connector AND expressed by the symbol $\wedge$. Therefore (7) become:

$$j_1 = +1 \wedge j_2 = -1 \tag{8}$$

Going back to the relation (3) and this time applying the connector OR ($\vee$) this will become

$$h_1 = +1 \vee h_2 = -1 \tag{9}$$

2010 *Mathematics Subject Classification.* 03H05, 81P10, 93A30, 97P20.
Key words and phrases. mathematical model, computer science, quantum computer.
Partial funding support of this work was provided by the University of Wisconsin-Whitewater, Wisconsin, U.S.A..

If we examine the relations (8) and (9) we see that they have the same binary character as the basic informative elements encountered in the computers case only that in this case instead of $+1$ and -1 we use 1 and 0. Thus, for the classical (digital) computers (CC) the informative basic elements used are $0 \vee 1$ and for the quantum computers (QC) these are grouped under the form $0 \wedge 1$.

In the next chapter we will analyze the possibility and the modality to convert the mathematical relations regarding the elements presented in this chapter, in relations applied in the computer case.

2. Mathematical Relations Applied to the Case of the Basic Informative Elements for CC and QC

We know the basic informative element formed of digits 0 (zero) OR 1 (one) in the CC case is named "bit" and we denote it with (b). In the QC case, the basic informative element is named "qbit" denoted with (qbit) and is formed from the pair of numbers 0 (zero) AND 1 (one).

The connector AND ($\wedge$) which makes inseparables the numbers 0 (zero) and 1 (one) applied in the QC case is because of the existence of a special behavior of the particles obeying the laws of Quantum Physics known under the name of "superposition" [3]. By superposition we understand, in fact, the existence of two simultaneous states with the reference to the particles submissive to the laws of Quantum Physics.

More concise, in [2] it is shown that "the digital calculation technology is based on the informative bits which all are either nothing or all – zero OR one – while ... the quantic calculation technology is based on q-bits which in essence are zero AND one concomitantly. The q-bit is based on the fundamental inherent ambiguity of the Quantum Mechanics"

Coming back to our proposed reason for this chapter we see that if we note with β_1 and β_2 the basis informative elements of CC then their values ($\beta_1 = 1 \vee \beta_2 = 0$) can be obtained from the values of ($h_1 = 1 \vee h_2 = -1$) conform relation (9), by introducing them in the relation of the form:

$$\beta = (h+1)/2 \tag{10}$$

Thus we have:

$$\beta_1 = \frac{h_1+1}{2} = 1 \tag{11}$$

$$\beta_2 = \frac{h_2+1}{2} = 0 \tag{12}$$

Correlating the two magnitudes (β_1; β_2) by "OR" ($\vee$), as previously shown in the magnitudes h case, we obtain the binary element

$$\beta_1 = 1 \vee \beta_2 = 0 \tag{13}$$

This constitutes even the basic informative element "bit" (b) characteristic for CC.

Thus we can write

$$(b) = (\beta_1 = 1 \vee \beta_2 = 0) \tag{14}$$

Proceeding similarly and using the above relations valid for QC case, if we denote

$$\sigma_1 = \frac{j_1+1}{2} \tag{15}$$

$$\sigma_2 = \frac{j_2+1}{2} \tag{16}$$

and if we correlate these two magnitudes (σ_1; σ_2) with the connector "AND" ($\wedge$) we obtain:

$$(qb) = (\sigma_1 = 1 \wedge \sigma_2 = 0) \tag{17}$$

3. Conclusions

Starting from dual unitary values $h_1 = +1$ OR $(\vee)$ $h_2 = -1$ and the bipolar unitary values $j_1 = +1$ AND $j_2 = -1$ analyzed in our paper [1], with very simple mathematical reasoning we arrive to develop some Mathematical models for the basic informative elements "bit" (b) and "qbit" (qb) characteristic for the classical (digital) computers (CC) and for the quantum computers (QC) respectively. It is important to underline the fact that the relations (13) for "bit" (b) valid for CC case as well as the relation (17) for the "qbit" (qb) valid for QC case have ultimately the same origin of the pair of equations expressed in an unitary way in [1]. These two equations of this pair distinct among themselves only by the algebraic signs, + (plus) or − (minus), which show the relation between the two terms y^2 and 1. Using an analogy from Physics we can say that one of the two equations of the respective pair is the image of the other equation "seen in the mirror".

References

[1] Baica M., Cardu M., *Dual and Bipolar Mathematical Models Derived from the Solutions of two very Simple Mathematical Equations and Their Application in Physics*, Transylvanian Journal of Mathematics and Mechanics, Vol. 4, No. 1, June 2012, pp. 1–7.

[2] Kurzweil R., *The Age of Spiritual Machines: When Computer Exceed Human Intelligence* (in Romanian), Paralela 45 Publisher, Pitești, 2012.

[3] Parsons P., *Has begin the Quantic Revolution* (in Romanian), Science World (BBC Focus Review), Jan.–Feb. 2013, pp. 24–29.

The University of Wisconsin
Dep. of Mathematical and Computer Sciences
Whitewater, WI. 53190, U.S.A.
E-mail address: baicam@uww.edu

S.C. Herbing S.R.L.
Str. Otetari 9, Sector 2, Bucharest, Romania
E-mail address: mircea.cardu@herbing.ro