The *Decimal* Pre-Exponent *"k"* Decimal Counter

By Fernando Mancebo Rodríguez

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This way the decimal pre-exponent is a method of double functionality: Firstly as systems of decimal units, and second as decimal exponent for mathematical operations.

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Strictly as per the compliance and regulations of :

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I. Introduction

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This way the decimal pre-exponent is a method of double functionality: Firstly as systems of decimal units, and second as decimal exponent for mathematical operations.

Principle and foundations of the decimal notation "k":

"Any quantity or decimal metric unit can be exposed in simplified or compressed way by means of a dual or bi-parametric expression formed by a base (a) or module of value and a pre-exponent (k) or decimal counter "

$$^{k}a$$

The base **a** contains the extract of the numeric value.

The pre-exponent **k** expresses the number of deduced or compressed decimals from the initial expression.

Example: 2.300.000.000----(^{k}a) = $^{9}2,3$.

The decimal pre-exponent K $^{k}\mathbf{a} = \mathbf{a}\,10^{k}$

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II. Development

The problem arose me in August of 2010 when studying the energy of waves. This way a tsunami is a wave of enormous dimensions and potential energy, while an electromagnetic wave is of minimum energy power.
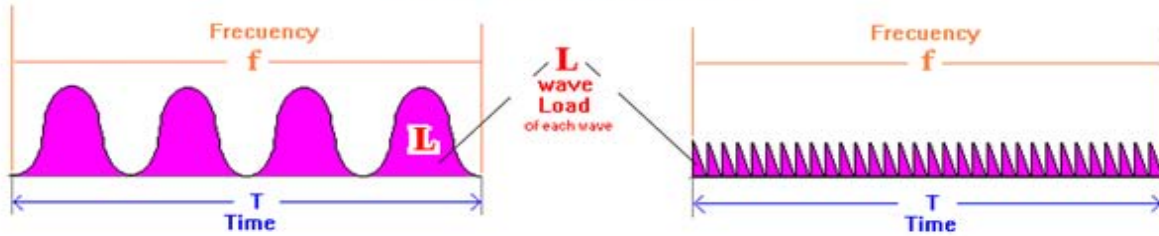
But how we can measure and relate the energy of both waves with the same energy unit, when for example the joule is insignificant for the tsunami and too big for the electromagnetic wave. And the solution would be:

Applying a method of units of wide spectrum that embraced from the infinitely small things to the infinitely big things.

And this method would be the one of getting a form of indefinite multiples of exponential decimal units, to know, the method of "k" notation.
Let us see:

With the unit of longitude, the meter, we make decimal units that are multiples of the same one, such as decameter, hectometer, kilometer, etc.

But this method soon stops to have simple and clear expressions when it arrives to certain values such as: 10^8 meters; 10^{11} meters; 10^{17} meters, etc.

This method consists on applying an exponential pre-index to the symbol of the chosen unit (^{k}m) which values and names to the new resulting unit.

The value of this is the exponent in base 10 that it is applied to this type of chosen unit.
For example, Angstrom = 10^{-10} metres is $^{-10}$m; A light-year ---- ^{16}m; 13×10^{12}m. ----- 13 ^{12}m.

Examples: Angstrom = 1 $^{-10}$m ; Light year = 1 ^{16}m ; Planck constant = 6,626 $^{-34}$j$_s$; 3,8 × 10^{21} m. = 3,8 ^{21}m

In practice, the "k" notation means the number of decimals that we should apply to the base **a**.

For example:

^{12}12,85 = 12850000000000.

^{4}12,85 = 128500.

$^{-4}$12,85 = 0,001285.

$^{-12}$12,85 = 0,00000000001285.

As we can see, the "k" notation k allows us any quantity of integer and decimal numbers in the base **a**, as for instance:

^{12}12,85 = 12850000000000.

^{13}1,285 = 12850000000000.

^{14}0,1285 = 12850000000000.

^{10}1285 = 12850000000000.

III. NOMENCLATURE

Although it doesn't correspond to me the definition of the pronunciation of this notation method, I would propose the following one:

^{k}m to name the expression "de" or "di" followed by the exponent and of the type of chosen unit. In the case of having chosen the meter, it would be: d-exponent-metre.

For example:

3,6 × 10^{32} metres = 3,6 ^{32}m = three comma six "de thirty two meters."

8 × 10^{20} joules = 8 ^{20}J = eight "de twenty joules."

25 × 10^{-34} joules = 25 $^{-34}$J = twenty-five "de minus thirty four Joules."

As we see, in these cases the definitions "de thirty two metres", "de twenty Joules", "de minus thirty four Joules", etc. they serve as name of the chosen unit, just as if they were decametres, kilometres; decimetres, millimetres, picometres, etc., but with a limitless application ambit.

Examples of nomenclature: In quantities

$4.000.000.000.000.000.000.000 = {}^{21}4 =>$ "four di twenty-one"

$9.000.000.000.000 = {}^{12}9 =>$ "nine di twelve".

$0,000.000.000.000.000.7 = {}^{-16}7 =>$ "seven di minus sixteen"

In decimal metric units.

${}^{7}m =>$ "de seven metres" => **Longitude unit** equivalent to 10.000.000 metres.

${}^{6}J =>$ "de six joules" => **Energy unit** equivalent to 1.000.000 joules.

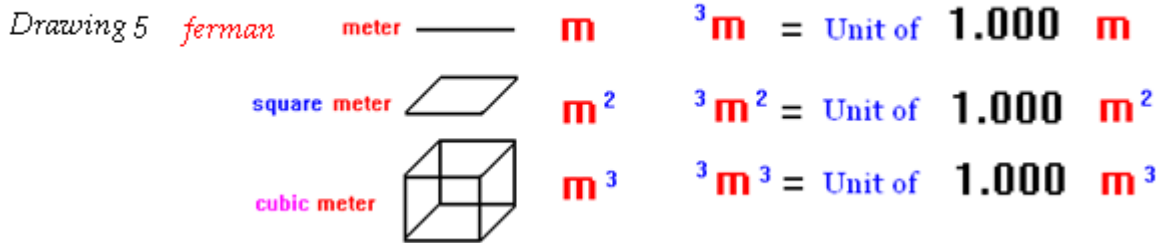${}^{-20}J =>$ "de minus twenty joules" => **Energy unit** equivalent to 0,000.000.000.000.000.000.01 joules.

${}^{12}g =>$ "de twelve grams" => **Weight unit** equivalent to 1.000.000.000.000 grams.

${}^{42}Kg =>$ "de forty two Kgs." => **Weight unit** equivalent to 1.000.000.000.000.000.000.000.000.000.000.000.000.000.000 Kgs.

IV. Dimensional or Physical Parameters

In the dimensional o physical parameters (e.g. meter, square meter, cubic meter) the "k" notation follows a logical rule considering the structural reality of the units firstly, to which we can apply later its corresponding multiples.

The pre-exponent K

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meter ———— m ${}^{3}m$ = Unit of **1.000** m

square meter ▱ m^2 ${}^{3}m^2$ = Unit of **1.000** m^2

cubic meter ▢ m^3 ${}^{3}m^3$ = Unit of **1.000** m^3

This way, we firstly look at the consistency of the unit (for example the square meter), and later on we apply its decimal multiples.

${}^{5}m$ = Unit of 100.000 metres

${}^{5}m^2$ = Unit of 100.000 square metres

${}^{5}m^3$ = Unit of 100.000 cubic metres.

* The flexibility of the decimal notation "k" allows us also the use of any other classic unit as for example:

The kilogram (${}^{3}kg$ = Unit of 1.000 kg.); the kilometre (${}^{3}km$ = Unit of 1.000 km.); the square kilometre (${}^{6}km^2$ = Unit of 1.000.000 square kilometres.); the cubic hectometre (${}^{4}hm^3$ = Unit of 10.000 cubic hectometres), etc.

In Mathematical Operations:

In the mathematical operations, the "k" notation simplifies a lot the expressions and therefore I believe that it could also be very useful sometimes.

Let us do some comparisons with the current method (scientific notation) and with the "de" notation.

$12 \times 10^{12} \times 6 \times 10^8 \times 5 \times 10^7 = 36 \times 10^{28}$

$^{12}12 \times {}^86 \times {}^75 = {}^{28}36$

$(12 \times 10^{12}) : (6 \times 10^8) = 2 \times 10^4.$

$^{12}12 : {}^86 = {}^42$

$^618 \times 6 = {}^6108$

$^515 \times {}^69 = {}^{11}135$

$^68 \times {}^56 \times {}^34 \times {}^25 = {}^{17}96$

$^46 \times {}^27 \times 38 : - {}^43 = {}^{13}112$

As we see the simplification is important, mainly because the "k" notation represents to a simplified number (or compressed number), whereas other notations as 6×10^3 ; 6^5, etc. they are

really operations that we must make previously to take out the number that we are looking for, which leaves some antiquated, obsolete and confused to the scientific notation.

Additions and Subtractions

To add and subtract quantities with "k" notation we can make it by means of the equalization of exponents "k".

For example:

$^{17}7 + {}^{16}8 + {}^{15}12$

Then we equal them, as for example to "k"= 15

$^{17}7 = {}^{15}700$

$^{16}8 = {}^{15}80$

$^{15}12 = {}^{15}12$

.... $^{15}792$

Powers and Roots

Powers with decimal notation ($^ka^n$).

The solution or result of a power with decimal notation is an expression with decimal notation and without power exponent, such that:

The decimal exponent is the product of the decimal and power exponents; and the new base would be the power of the initial base.

The pre-exponent K
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Powers and **roots**
Potencias y Raíces

Decimal exponent · Power exponent

$^2 7^3$

$^2 7^3 = {}^6 343$
$^5 8^2 = {}^{10} 64$

- Product of exponents
- Power of base

To make multiple of

$\sqrt[3]{^{11}5'12} = \sqrt[3]{^9512} = {}^38$

- Division of decimal exponent by root
- Root of the base

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Roots of expressions with decimal notation

For the resolution of roots with decimal notation we will follow the next phases:

1.- In the first place we make multiple of the root to the decimal exponent.

2.- Subsequently we solve by means of two steps, which will give us as solution the resulting decimal expression:

A----We divide the decimal exponent by the root and we put it as resulting decimal exponent.

B----We solve the root of the initial base to obtain us the resulting base.

Other possibilities for the use of the decimal notation "k" exist, such as expresion by mean of series, etc.

We can also use this notation in variety of symbols and concepts, as for instance in the mathematical set:

^{2}Ships = Fleet of 100 ships.

^{3}Birds = Goup or flock formed by 1.000 birds.

^{4}Trees = Group of trees or forest formed by 10.000 trees.

^{11}Stars = Group of stars (or galaxy) formed by 100.000.000.000 stars.

Conceptual Meaning:

As general rule, although not strict norm, the decimal notation "k" has some significant differences either when it is applied to numbers and quantities or when it is applied to elements and concepts.

A-- When it is applied to numbers the decimal "k" notation gives quantitative connotation, that is to say, it alone tells us the quantity or numeric value of the expression.

B-- When it is applied to elements or concepts, the "k" notation would indicate us, not alone the value of the expression, but rather the concept and meaning of group, set or structural unit.

Example:

A --- ^{11}3,5 Stars = 350.000.000.000 stars, independently of their organization and situation.

B--- 3,5 ^{11}Stars = **Set or group** of stars (galaxy) formed by 350.000.000.000 stars.

Summarizing, in one hand the notation "k" helps us to express big (or extremely small) numeric quantities in simple or easy way.

And on other hand, it allows us to use a limitless set of units of any type.

In the practice, if we put the "k" notation in a number, this will take the exponential value that the "k" notation has, and if we apply it to a unit symbol, this will become another unit of the "k" notation level, (for big or small that this is).
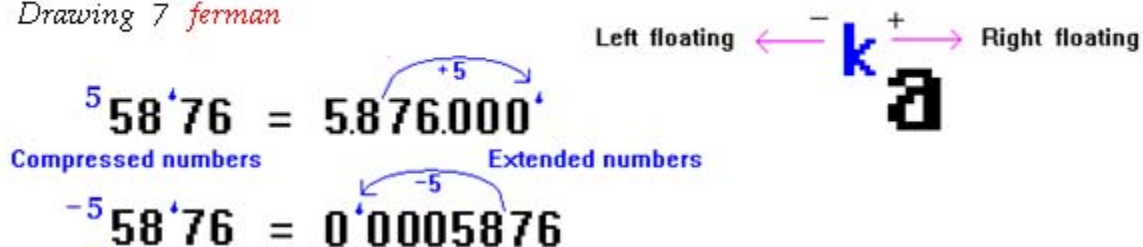
We have also seen that sometimes we can apply the "k" notation at the right side of the base for operative reasons, and in this case we should add the letter "d" for not having power confusion.

V. FLOATING POINT

The decimal notation has a direct relation with the method of floating points since, by itself, the decimal exponent (k) marks us the displacement toward the right (+) or toward the left (-) that we must give to the point that separates the integer part from the decimal one in the base (a) to get the initial extended number.

Notes

The pre-exponent K **Floating point** ◆ **Coma flotante** 2010-8-26

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Left floating ⟵ ⁻ **k** ⁺ ⟶ Right floating

$${}^{5}58{}^{'}76 = 5.876.000{}^{'} \qquad (+5)$$

Compressed numbers   **Extended numbers**

$${}^{-5}58{}^{'}76 = 0{}^{'}0005876 \qquad (-5)$$

* To understand us better with the application of the decimal notation, to the initial number we will call it **"extended number"** and to the number with the decimal application will call it **"compressed number"**.

VI. Discussion

The following explanation and discussion is for those who like to know the antecedents and reasons of this proposal.

At the beginning of August of 2010 I was studying and revising the different metric units and their corresponding multiples when I notice that for any unit type, for example the meter, we establish a letter or symbol to designate it and a value-pattern to value it.

Now then, as we need multiples and divisors of any unit-pattern and we use in mathematics the decimal systems, because we conceive the multiples and divisors following this decimal system.

This way, the multiples of the meter would have:

10 decametre, 100 hectometre, 1000 kilometre, 10.000 miriametre, etc.

And the divisors:

1/10 decimetre, 1/100 centimetre, 1/1.000 millimetre, etc.

Then, to designate these multiples we use a relative prefix to their first written letters:

Dm--decametre; hm--hectometre; km--kilometre, etc.

Dcm--decimetre; cm--centimetre; mm--millimetre etc.

And it is here where the first problem arose me, since the applicable letters are scarce and contrarily the numbers, and therefore the multiples, are infinite.

But also in the previous or "classic" form of representation and expression of multiples and divisors of metric units, another problem or complication exists: we should know the numeric value that we have given to each letter.

Therefore we must translate the letters with which we designate to the metric units in numeric values to take conscience of real value of the unit that we are valuing.

And due to these units and their representative letters are diverse, because to remember their real values can be complicated and can induce us to errors.

k--kilo, M--mega, G--giga, T--tera, P--peta, E--exa, Z--zetta, Y--yotta.,

So the logical question arises immediately:

What reason exists to use letters that produce us so much confusion?

Then, we could forget the letters and to put numeric decimal values directly as prefix of the chosen metric unit.

k--kilo, M--mega, G--giga, T--tera, P--peta, E--exa, Z--zetta, Y--yotta.,

$---^3$m$-----^6$m$------^9$m$-----^{12}$m$-----^{15}$m$-----^{18}$m$----^{21}$m$-----^{24}$m$----^{27}$m$---^{35}$m$-----^{45}$m$-----^{59}$m. .... ^{N}m.

This way the number of multiples and divisors it is limitless and there is not confusion possible of value since each number indicates us the value of the unit.

So, ^{9}m "de nine meters" means an unit with value in meters equal to 1 followed by 9 zeros.

Now then, what is good for the decimal metric units, also is good for any other symbolic or numeric concept.

This way if we have the number 14 and we apply it the previous notation (decimal notation "k" ^{k}a) $^k14 = {}^614$ then this number will become a value of 14 followed by 6 zeros, 14.000.000; for k=8 we write ^{814} and it value is 1.400.000.000 etc.

As we have seen before, this form of mathematical expression is also very useful and simple to make mathematical operations.

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Notes