Chapter 1

Introduction

The first time I heard about logarithms, it was at school - as for many people, I guess. However, I remember this event as if it occurred yesterday because the teacher in our school said something extraordinary. After having explained the concept of logarithm, he said : "In our calculations, we make additions and subtractions because the world we know allows that we solve several everyday life problems such doing. Two apples will cost the double of the price of an apple. But, if the world were logarithmic, what would these additions and subtractions mean ?".

I was very impressed by this question, and several times in my life afterwards, I tried to think as if the world would be logarithmic. For instance, I invented a joke with the proof that "$1 + 1 = 2$" because one had to multiply the natural number "e" by itself and then take the logarithm of the result, as we were, in reality, in a logarithmic world.

What we observe is "$1 + 1 = 2$", but what really occurs is : "$ln(e^1.e^1) = ln(e^2) = 2$".

Also, when as a young adult I was thinking of several proportions in the universe, the logarithmic screening proved very helpful. For instance, it is possible to compare the dimension of the universe with Avogadro's number. There are about 100 billions (10^{11}) stars in a galaxy and about 100 billions (10^{11}) galaxies in the universe. And our star, the sun, has about 10 planets turning around it. Therefore, the proportion between the universe and our earth is about 10^{23}. In other words, there are about 23 orders of magnitude between the universe and our planet where we can walk, travel and design experiments.

Avogadro's number ($6.022045\ 10^{23}\ mole^{-1}$) gives the number of molecules in a mole of matter that we can hold in hands. Therefore, the proportion between a mole of matter and a molecule is also about 23 orders of magnitude. This is interesting because it gives us the limits of what we can investigate. There are 46 (or maybe slightly more) orders of magnitude to describe all classes of objects in the world that we have access to, and we are just in the middle of it. We can investigate up to about 23 orders of magnitude in the direction of the bigger than us. And the same in the direction of the smaller than us.

Concerning the time, things are a little bit different. There are 43 orders of magnitude in time between Planck's time ($10^{-43}\ sec$) and a second (that kind of time interval anyone can have an idea of), but only 17 orders of magnitude between the first second of the universe and now, 14 billions years after the Big Bang ($14\ 10^9\ years \approx 4.4\ 10^{17}\ sec$).

I hope that we shall not have to wait an additional 26 orders of magnitude ($43 - 17 = 26$) in the future to know the last word of this all ! But, it gives a feeling of natural order that the whole series of huge phenomena between the Big Bang and the formation of atoms and galaxies extended over as many as 43 orders of magnitude in time, but that the universe continued its expansion only over 17 orders of magnitude, corresponding to much less dramatic and spectacular changes, up to us. That life, i.e. all bacteria, dinosaurs, mammals, humans, including Tuma, Ororin and Lucy, and finally you and me, all appeared in a small part of the last 60^{th} order of magnitude makes of it a very concentrated event on a logarithmic scale.

Similarly, when I started analysing creep curves (see Chapter 3), I was amazed by the way the results of creep tests were classically presented especially for what regards the start of the curves. Let us, for instance, say that for a test lasting 10 hours we record the strain every 2 minutes (curve of 300 points). If one is above the critical temperature, this will give a beautiful creep curve with three stages. However, an initial stage has to be added (and is indeed often added in handbooks where it is called "instantaneous strain"), because the measured initial strain is not nil. The question then raises : what does this initial stage mean ? (what do