Easy explanation of the Radial Coordinates

Radial Function, $R_t = f_r(R_0)$

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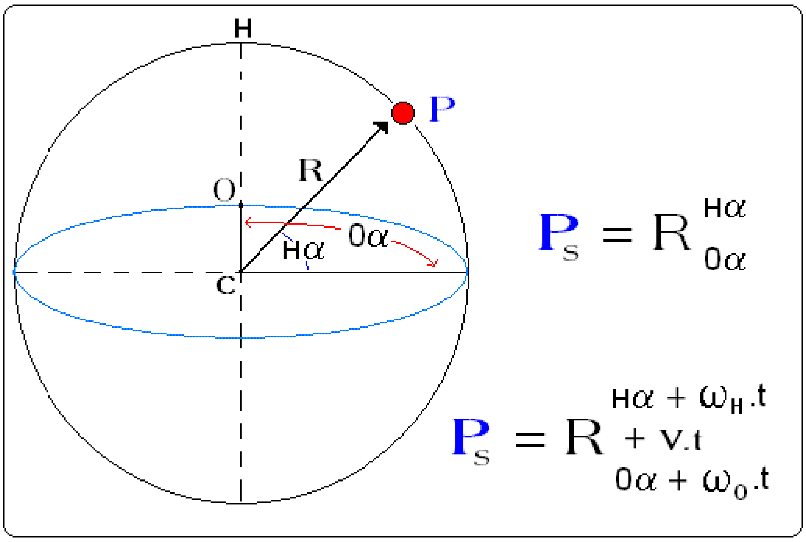
Radial Coordinates



Explanation

"Radial coordinates are spherical coordinates in motion"

These coordinates don't use, as base, trigonometry parameters of union with the Cartesian Coordinates (sin, cos, etc.), but vectors of speed W (angular) V (lineal).

That way, this coordinates type can be defined as **dynamic mathematics**

The radial coordinates are a system of spherical coordinates that are used as group when being united and developing all their parameters by means of a time vector.

This vector of time -taking it from its beginning until its final- unites and makes work to the whole group of formulas and parameters, with which the result can express us motions and geometric figures.

For it, we apply the formulas of radial coordinates to an imaginary particle **(P)** that travels and draws us movements, drawings and geometric figures that we want to build.

In the drawing this system is shown; in which **P** is the imaginary particle that will describe us the figures that we would compose.

--**C** is the centre or support point from where we will build the figure or motion.

--**R** is the radius or distance from the centre C to the particle P in each moment.

--**O** or Alfa, is the radial coordinate in horizontal sense. This coordinate is measured in degrees and in angular speed (Wo)

--**H** or Beta, is the vertical coordinate that is measured from the horizontal coordinate O. It is measured in degrees and angular speed Wh.

--**t** is the time that unites to all the parameters of each formula and impels them motion.

Besides these simplified formulas, in many cases we can substitute parameter of angular speed (W.t) for vectors of speed (v.t).

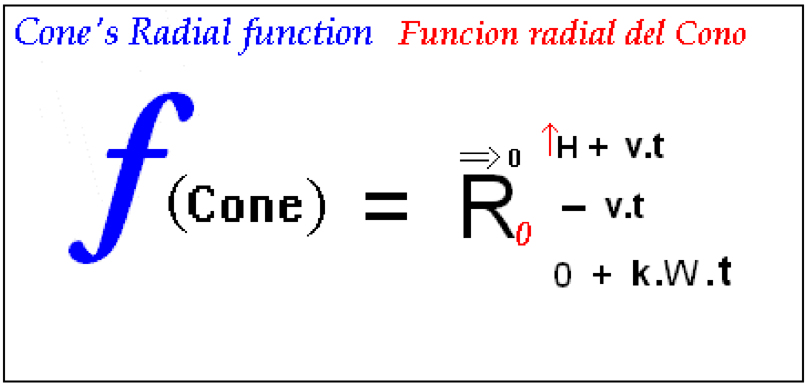
For example, the angular speed of H, (Wh) can be substituted by a displacement vector (v.t) of the point C toward the vertical H.

Addition of more coordinates and vectors of motion can be made in formulas also.

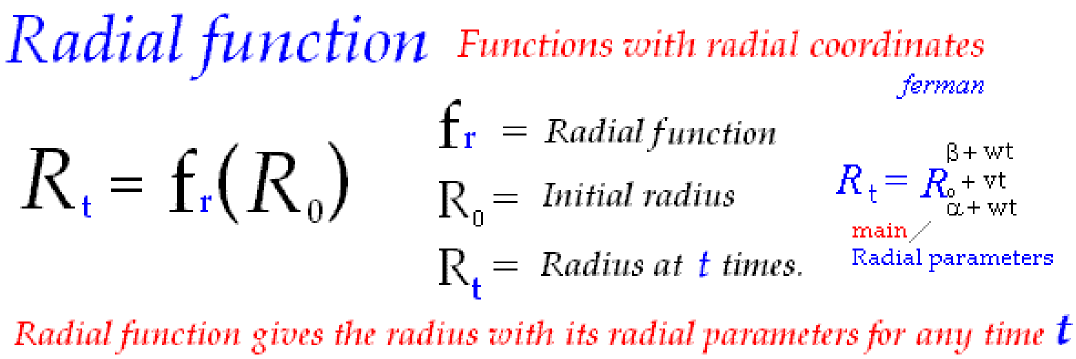
Formulas

In this first study of radial coordinates we will see mainly the formulas that we will use to describe figures and geometric bodies in space.
As in this case what interests us is not the incidental situation of the P particle that draws the geometric bodies, but the whole figure already created, because we will use the letter f that will mean "figure that it built and described by the formula" with a suffix that say us the noun of the figure to build.
So here we can see as the formulas of radial coordinates aren't numeric equalities, but geometric equalities where the parameters of the second term defines the points, figures o geometric fields that are expressed in the first term.

This is detailed in following drawing:



As we can see, the radial coordinates are series of parameters of together actuation on the radius R those which define us figures and geometric forms, on which, these parameters are converted into variables with relation to a common time of application.
For instance, given the rotational coordinate O, with angular speed W, where its angle is converted into variable by mean of the actuation of the common time of application t.
Very important question:
The formulas of radial coordinates are formula of systems in motion, in which a supposed particle (P) with radius (R) and on a centre (C) describes us geometric figures during certain period of time.
It means that if what interest us is to know the parameters of radius R and situation of the P particle on the "radial sphere", we have to go into in the formula to take out it for the value of time that we want.
For it, we can use a more specific mathematical formula as can be the radial function that we see in the drawing:

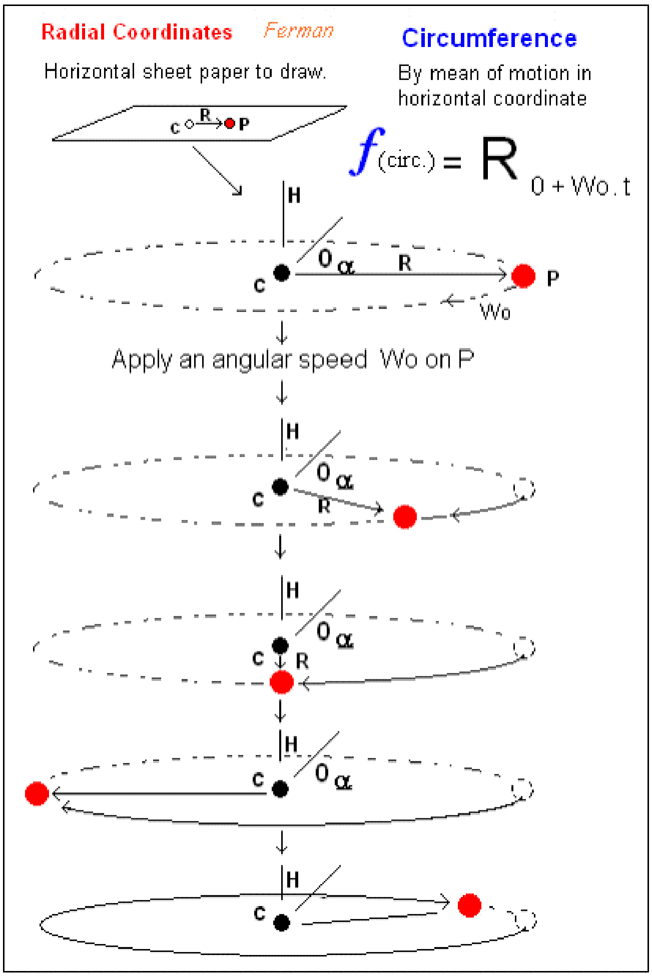


But here, we normally use the idea of the definition of a geometric figure by mean of the radial parameters of these figures.

Use examples:

Now we will see some very simple examples of how the radial coordinates can be used. Nevertheless their use is limitless and all type of figures and geometric bodies can be built, as well as orbits, movements, etc.

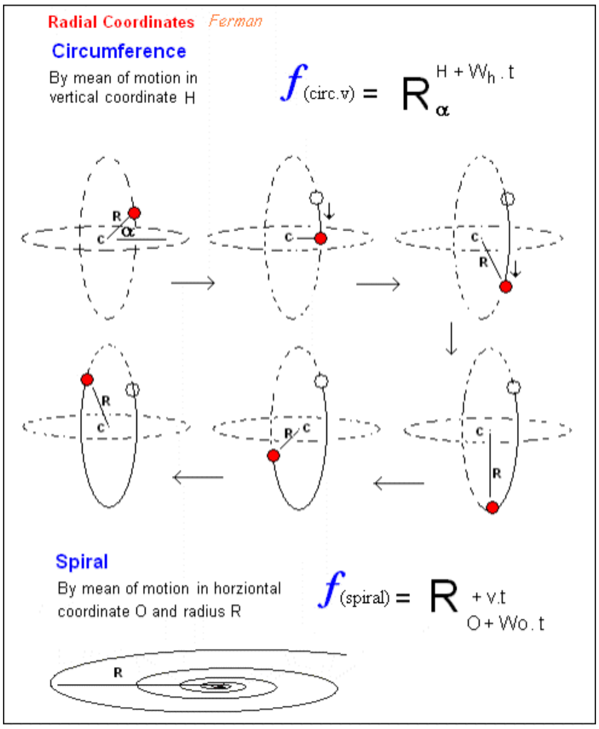
Circumferences   Drawing 2



Circumferences could be considered as the simplest figures that we can build or draw with the radial coordinates.
In this case it is enough with locating a central point C as centre of the circumference; a radius R that will give us the width of the circumference and a starting point P that will be the place where we will begin to build it.
As we will see after, circumferences can be built in any direction, according to the radial coordinates on which we apply the motion.
The first circumference to build will be one located on the horizontal coordinate, just as if we were making it with a compass on a paper sheet on our table.
For it, we could imagine that we take a drawing sheet putting it on our table.
In the drawing 2 we see this construction example, observing firstly the paper on the table.

On that horizontal plane (that will call it now and later O coordinate) we fix a central point C that we will take as centre of the circumference. Likewise, we measure a distance R (radius) toward a point of our pleasure P to fix where we begin to build the circumference.
To draw the circumference, the only thing that we have to do is impel an angular speed (Wo) to the point P and to make it rotate around the point C or centre.
Therefore, it is the same thing that we would make with a compass, but this time building an imaginary circumference by means of a mathematical formula.
Now well, to represent this mathematical formula we use the general formula of the radial coordinates showed in Drawing 1 that consists of a main letter R that is the radius and some indexes and sub-indexes that represent each one of the radial coordinates.
This case of the drawing of circumferences on the horizontal O coordinate, the formula is the one of the drawing 2. R as main parameter with the sub-index O + Wo x t.
--The radius R is a constant that we can choose to give width to the circumference.
--The first mark of the sub-index (O) it is the point of the coordinate where we want to begin to build the circumference.
--Wo is the angular speed of turning that we give to this O coordinate.
--And t is the time, during which, we want to the circumference is being built.
We will see that this time could be infinite. This case the circumference will be constructing continually.

Circumference on the vertical coordinate H Drawing 3



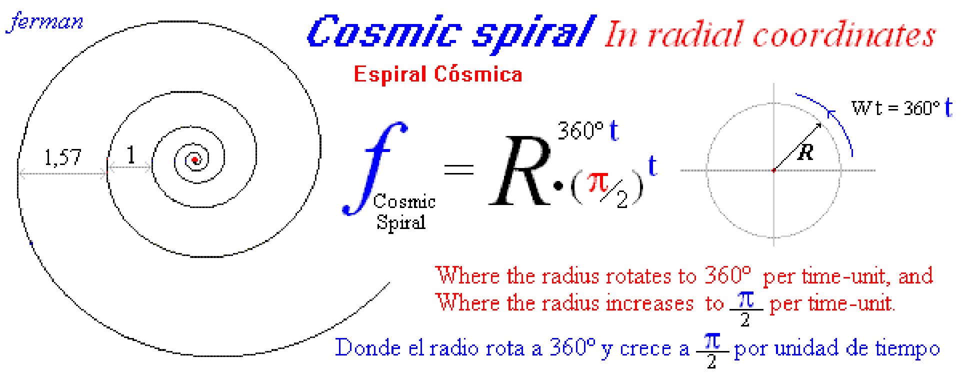
Drawing 3

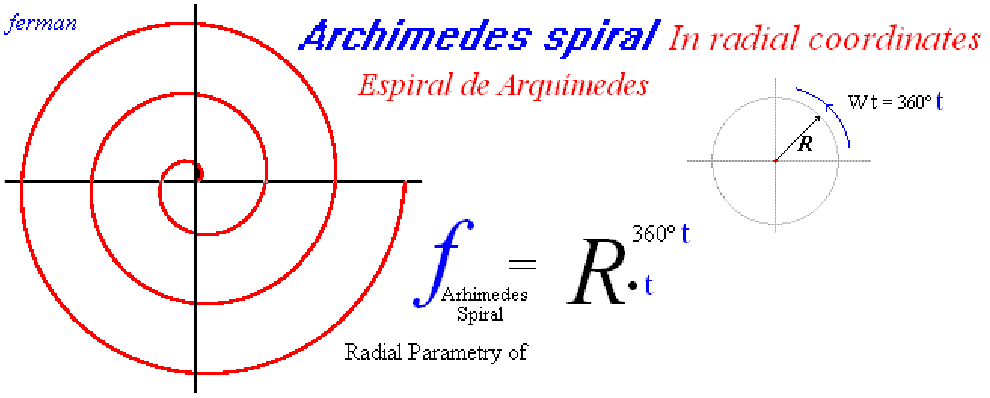
In the same way that we build the previous circumference on the horizontal coordinate O, we can also make it on the vertical coordinate H. (Drawing 3)
In this case we also fix a central point that coincides with the central point of the O coordinate, and from it, we measure a radius in the direction that we would. At the end of the radius it will be the point from which we will begin to build the circumference in vertical.
In same way as in the previous circumference, in this vertical one we give an angular speed turn Wh around the point C, with which we obtain a vertical circumference.

The formula will be represented in this case (drawing 3) by the centre C; the Radius R of the circumference; the angular speed Wh of the H coordinated, by the time of execution t.
This case we also need to define the situation of the circumference regarding to the O coordinate. So we put the value (Alpha) of this coordinate O in degrees.

Spiral ones

The same as circumferences, spirals can be drawn in any position.
If for example we want to make it on the horizontal or O coordinate (end of drawing 3), we mark the central point C (or anyone of the O coordinate) and we proceed the same as with the circumference, that is to say, giving an angular speed Wo to the point P (that coincide with the centre in this case) to make it rotate on the central point C.
The great difference with the construction of circumferences it is the R parameter, which is constant in circumferences and in spiral ones the radius R goes increasing in longitude when applying it a motion vector v.t.
Therefore in any spiral one, beside the angular speed Wo on the point P also a lineal speed v toward the exterior exists.
These two synchronized motion types make that the spiral one can be built.
The formula would be the one that expresses the drawing 3 with two sub-indexes, one to show the angular speed, and another to define the continuous increase of the radius R.



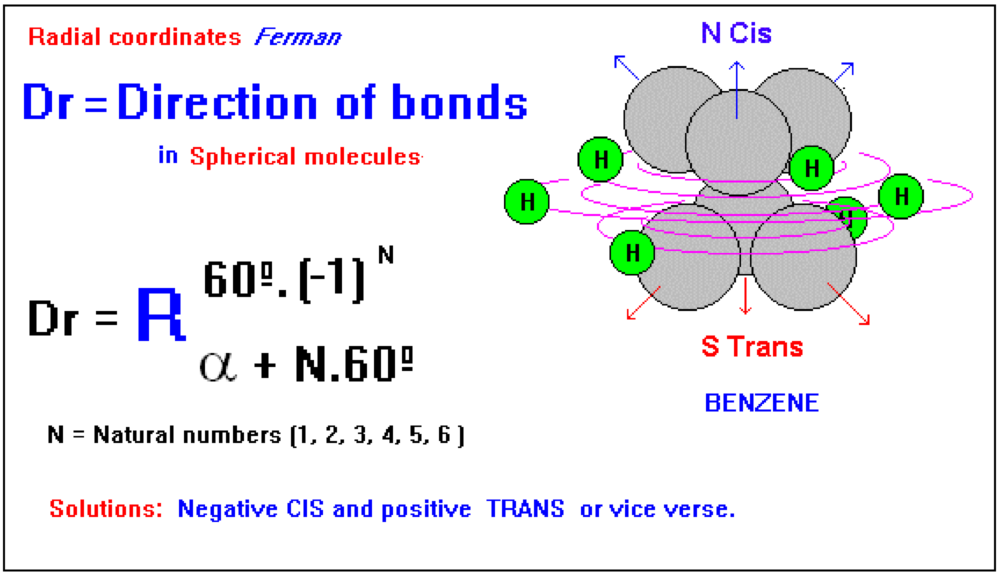


The Radial Coordinates as motion vectors

"In the radial coordinates at least a coordinate that is subjected to any type of motion have to exist."

"Although, in many circumstances we can use the general formula of the radial coordinates to describe immobile parameters or sets of them using our formula of radial coordinates."

As example of this, we could have the description of the directions of bonds in the spherical molecules that is detailed in the drawing:.

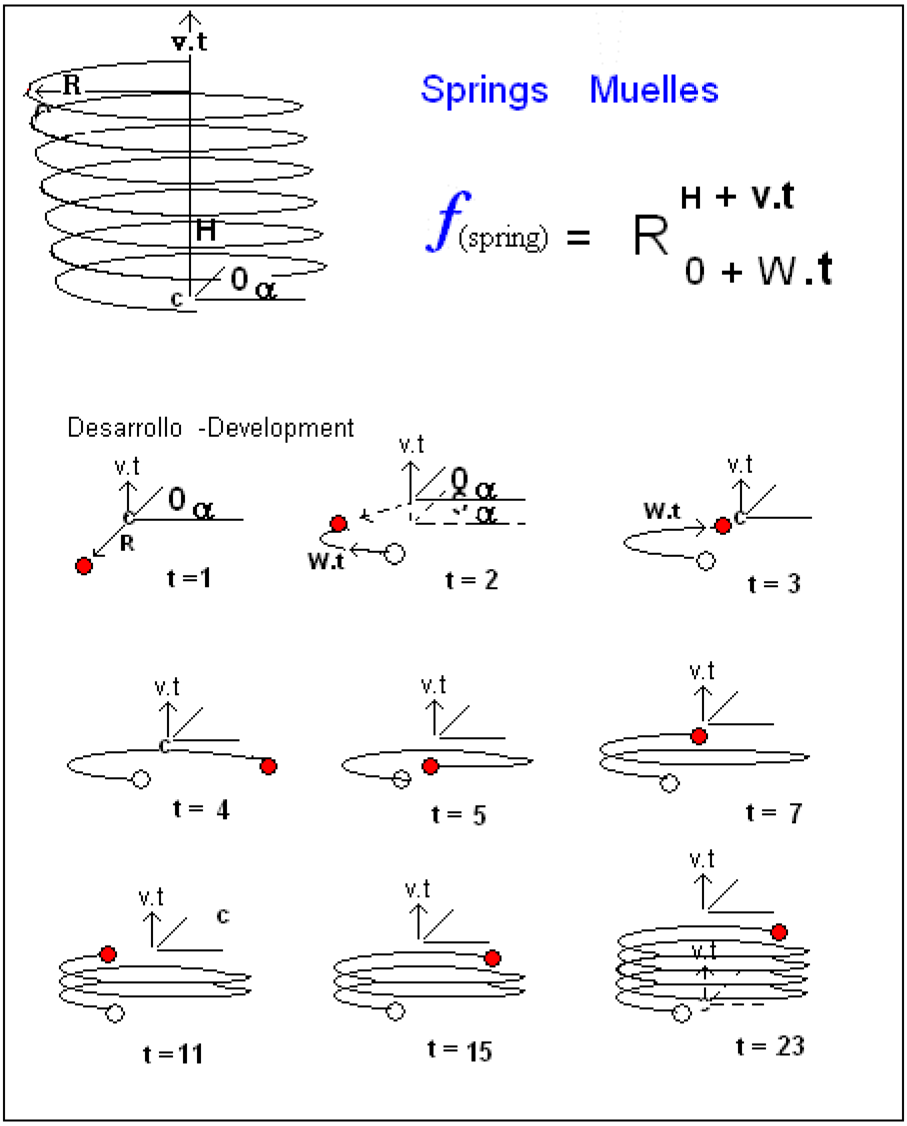


Apart from these circumstances, and as what we will see in this study are the radial coordinates in motion, then we will revise almost exclusively the importance of the motion in the same ones.
And this is clearly showed in the simplest applications, as for example in the circumference:
If in the construction of a circumference, we apply a small angular speed, for example of 10Â° per second, then we would see perfectly the rotation of the point that describes the circumference. But if we apply a high angular speed, i.e. 560 degrees second, in this case hardly we would see the point and alone we would see the described circumference.
This is important for the construction of figures due to it is interesting to see (or to imagine) the lines and surfaces in a compact way and without fissures, that is to say, not to see the point that moves, but the figure that is described and drawn by this point that moves to high speed.
It is also basic for the creation of figures with the appropriate form, since in most of the cases we need that part of the figure is built firstly, so later, we can move this drawn base to be able to get the entire structure of the figure.
It happens this way in such figures as the cylinder, which needs that the angular speed of the base or circumference (coordinate O) it is much bigger than the displacement of the H coordinated, because it wasn't this way, instead of a compact cylinder we get a simple spring with hole spaces among their coils.
Therefore, one of the essences of the radial coordinates is to know how to manage the relationship of speeds among each one of these coordinates.
For it in the formulas, the constant K could be 360 or other high value.
One can make this way a much speeder coordinate in comparison with another of the formula.

Let us see therefore, some examples more on radial coordinates, although as I said at the beginning alone we are treating the simple forms to have a basic idea, but its reach is limitless, being able to end up building formulas with multitude of equations of this type of coordinates in such a way that many figures are built at the same time while they are modifying, moving and relating some with the other ones.
They can also be built any type of figures, as polygons, polyhedrons, etc.
Let us see these examples, any of them with K constants.

Springs

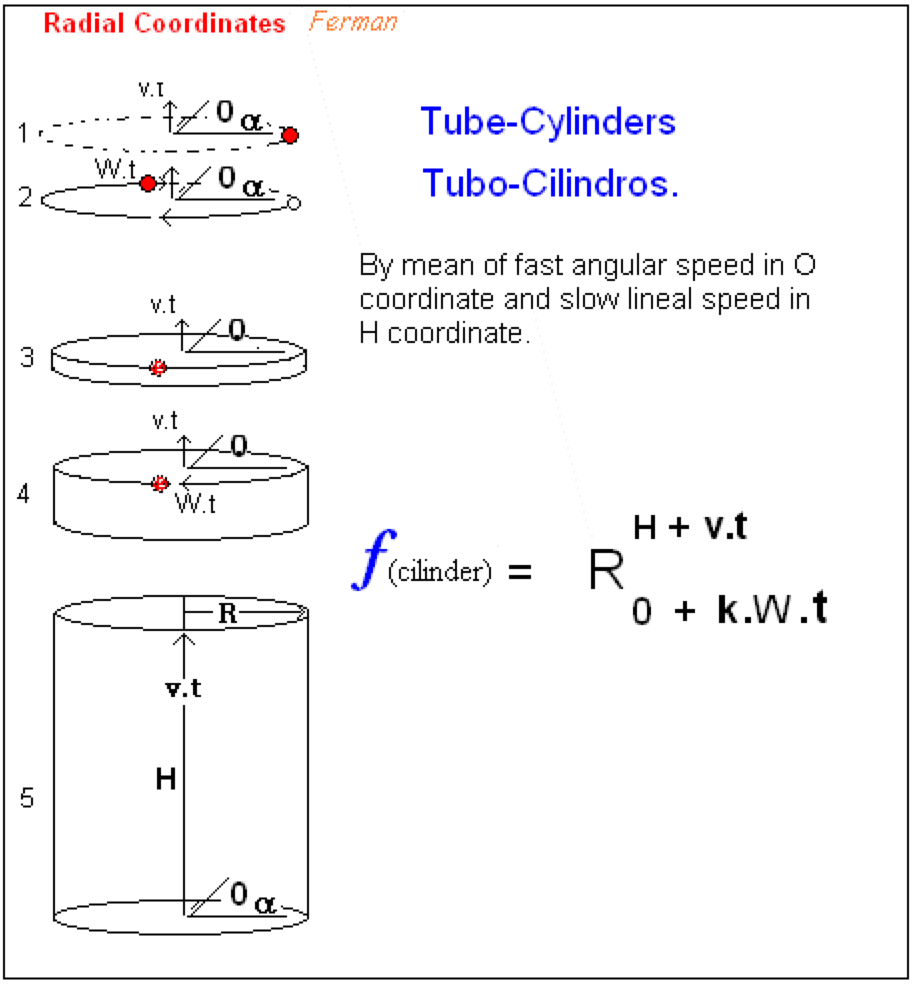
The first example is spring, in which the construction of its circumference is gotten by the angular speed Wo and the time t.
To the C point we have given motion toward the H coordinate H (up), whose speed is v.t.
So, the spiral or coil opening depends on the speed v that we give to the H coordinate.
This up movement is the one that produce the separation among coils.
In this example if we maintain constant the radius, we will have a regular spring. If we go changing the radius we will have different spring shapes.
The formula is shown in the drawing.



Drawing 4.

Tubes and Cylinders

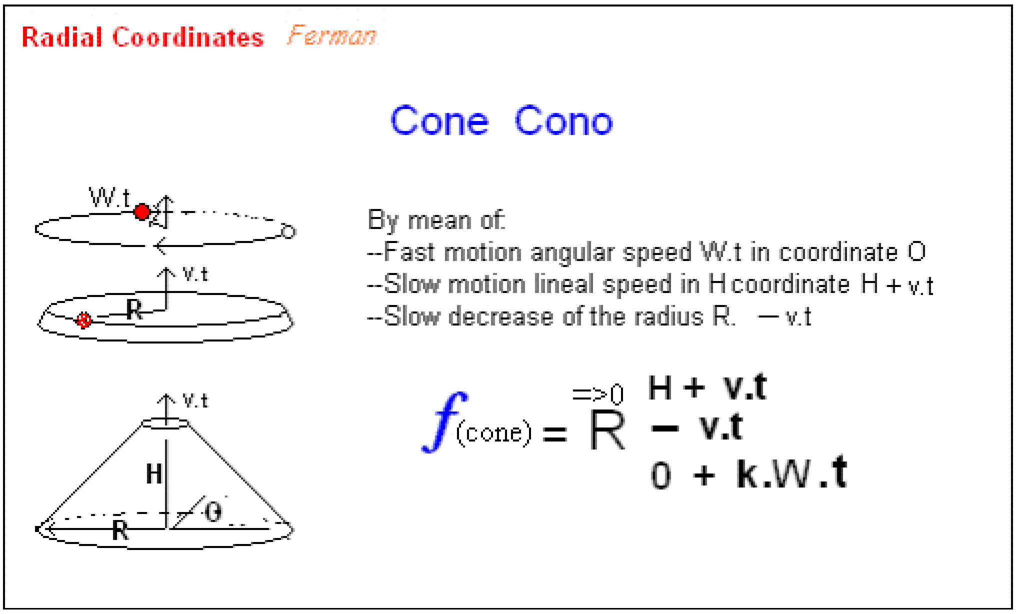
In this example we see the construction of tubes and cylinders for which we use the same parameters that for springs, but using a constant K of high value to get that the surface of the same one is compact and don't have void spaces as in springs (among coils).
This is an example of the utility and relationship of the K constants among coordinates.
This case, it has been able to create and to maintain the apparent and compact form of cylinder's wall, first due to the high speed of the horizontal coordinate O, (K.W), and later making this circumference moves up getting the figure of the cylinder.



Drawing 5

Cone

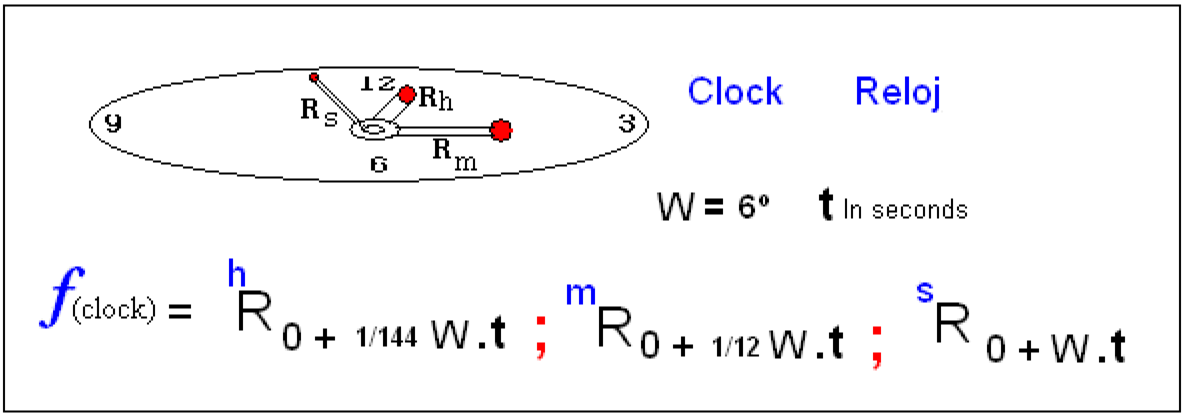
The radial coordinates have the particularity of diversity and possibilities almost limitless, which allows each one of us to choose, adapt or build our particular formulas according to the figures, motions or works that we want to describe.
In the case of building cones different possibilities exist according to the direction, way of construction etc., that want to choose.
In this case I expose a formula to build a cone beginning with the base and developing in the coordinated H direction, but it could have been in any other way.
In this chosen way, we begin giving to the radius R the dimensions that we desire that the base of the cone has to have.
Subsequently, we give a high angular speed to the O coordinate to build the circumference of the base, and at the same time, a slower lineal speed to the coordinates and C point the vertical direction H.
As the coordinates go advancing up and so that the conical form takes place in the figure, we go decreasing the radius R with value - v.t.



Drawing 6

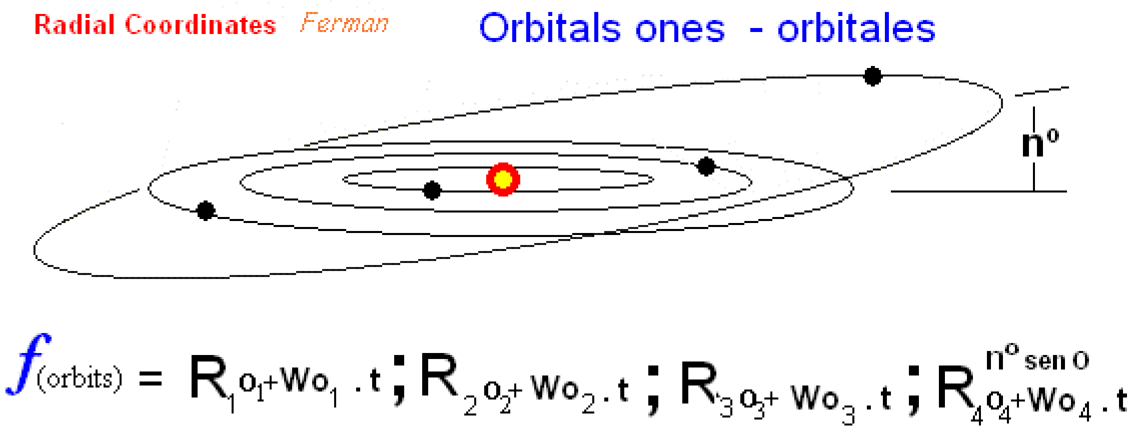
Clock

In the example of clocks the H coordinates don't exist, because we alone have hands rotating on the O coordinate.
In this case there are three radial coordinates (one for each hand) united by the factor time.
As a relationship of turn among hands exists 1, 12, 144 and the motion of 6 degrees/second in the second hand, then alone it is necessary to apply this relation among them.



Drawing 7

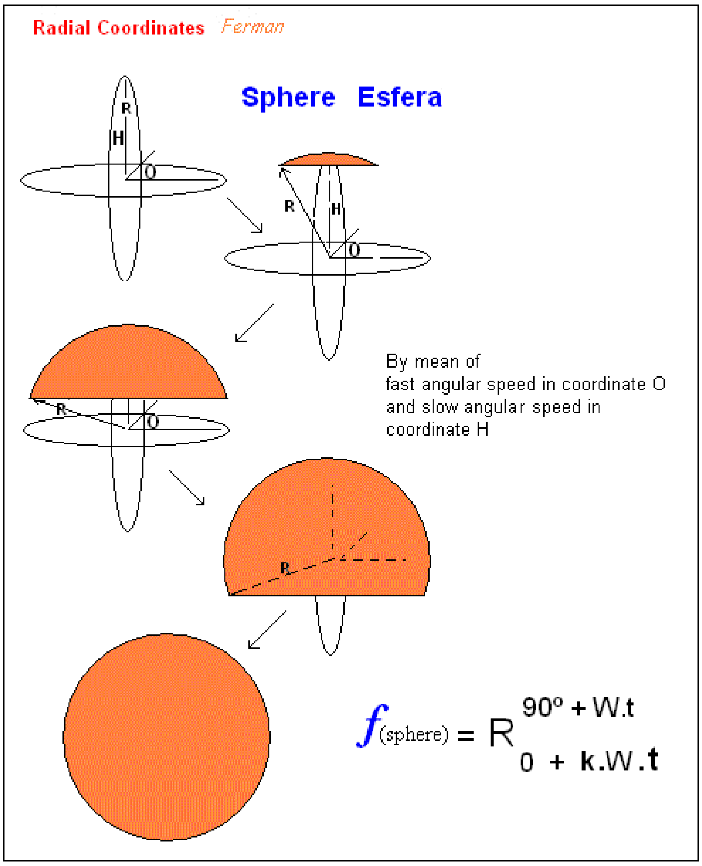
Orbital ones



Drawing 7b

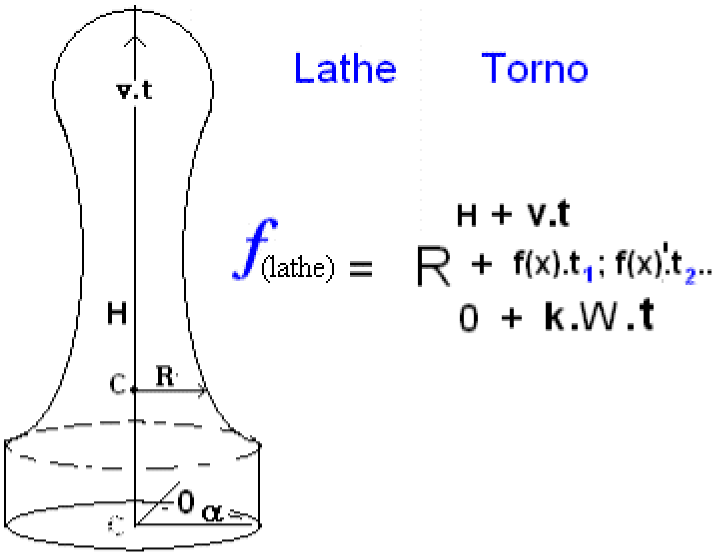
Sphere Drawing 8

The construction of spheres is also quite simple.
Alone it is necessary to give angular motion to the coordinates O and H.
For it, we choose a motion with high angular speed for the O coordinate so that we can form the initial circumference and a compact structure of the sphere.
Also, we give a slow angular speed to the H coordinated so that the path running by the radius R goes completing the construction of the sphere.
In this concrete case, we have given an initial value to the H coordinated of 90 degrees to begin to build the sphere for the up part. But many ways of building it exist.
--Important--- We remember the H coordinate is always measured starting from the situation of the O coordinate with object of synchronization among these coordinates.



Lathe

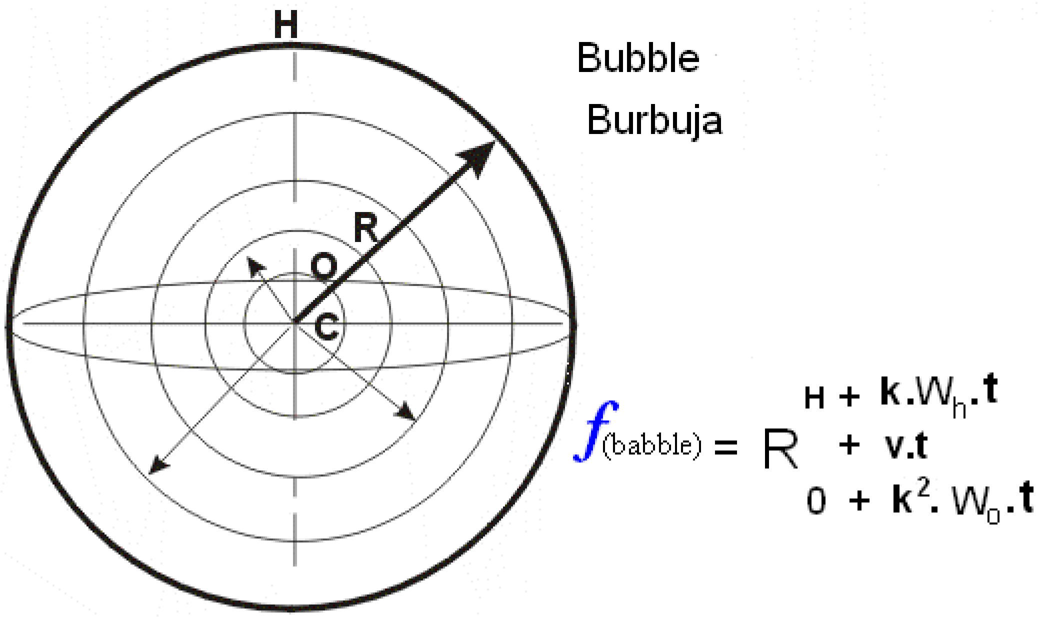
The example of the lathe is interesting since we can build all type of pieces lathed with this formulas of radial coordinates.
The cutting speed will give this way by the H coordinate plus the speed v for the time t.
The form of any lathed piece will be obtain by mean of the functions f(x) on the radius, that is to say, the increase or decrease of the radius in each moment in the cutting of the lathe.
The times t1, t2, t3 tell us the period in that each function f(x) or f(v) is applied. The sum of every period will give us the total time t.
In the figure, we see that in the first tract f (x) is single constant, because the radius doesn't vary.
In the second tract, the radius goes varying with relationship to f (x)' and this function create the superior form of the figure.
The constant K, as always, helps us to define the figures in a balanced way and without fissures among lines.



Drawing 9

Bubble or Big-bang

The formula for bubbles, which beginning from a point, can go increasing indefinitely (while time is applied) it is also applicable to the possible or theoretical development of Big-bang.
In this formula we have the development of the horizontal coordinate O firstly, with its angular speed Wo and the time of application defines us a circumference.
The H coordinate with its angular speed Wh in conjunction with the O coordinate defines us a sphere.
The speed v for the time t that is applied to the radius R goes increasing this radius indefinitely, and therefore the sphere, bubble or Big-bang.
K and k^2 are used to be able to define the suitable structure of the pieces.

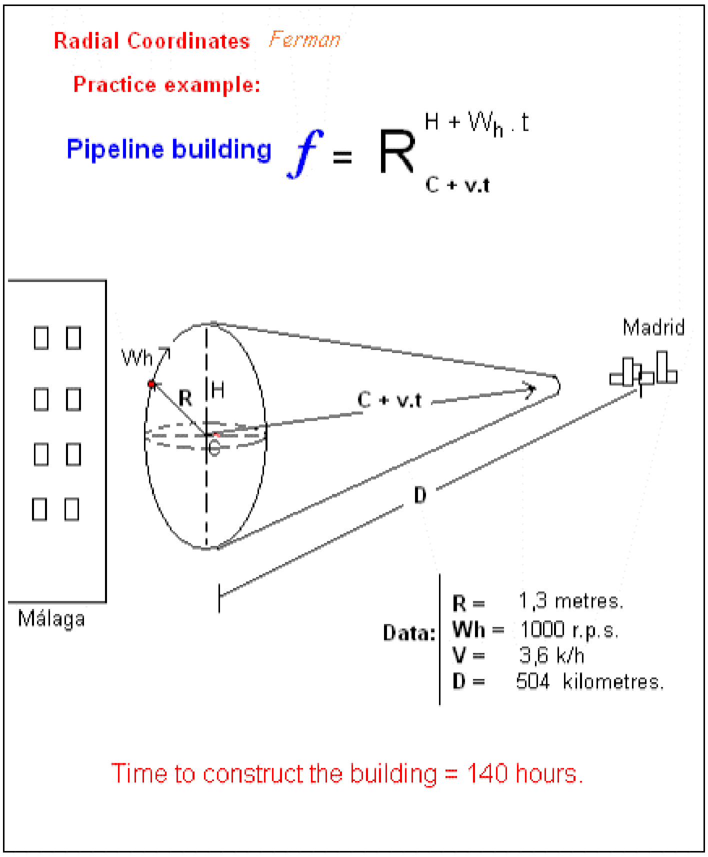


Drawing 10

Till here, simple samples of ways of use of the radial coordinates with object that they can be known.
We will already have time of enlarging their possibilities, with such figures as polygons, polyhedrons, screws, motions, orbital ones, etc.
At the moment and as practice (although quite simple example) I will put an imaginary problem of application.

Problem: **Construction of a pipeline Malaga-Madrid.**

Let us suppose that I want to make (imaginatively, of course) a pipeline between the port of my city (Malaga) and the centre of the country, Madrid.
The distance is of about 504 kilometres.
So I decide that the pipeline will have a radius of 2'6 meters of diameter.
For it I use the vertical H coordinate to create the width or circumference of the pipeline, with a radius R of 1'3 metres.
So that the circumference leave well marked, I give high angular speed to the H coordinate. Let us say of 1000 revolutions per second.
Then I give a speed of displacement to the C point and coordinates with direction to Madrid.
This speed can be of 1 metro/second or 3'6 kilometres an hour.
Now well, if I don't make a mistake in the calculations, 140 hours after beginning the construction of the pipeline, this will have arrived to its destination, Madrid.
But other characteristic of the radial coordinates is to know the anterior, current and posterior positions of their constructions, and we can discover in each moment for where the construction of the pipeline is developing with alone applying the lapsed time from its beginning.
Likewise, applying the parameter time t we can discover for where the pipeline went being built in any moment or for where it will go in a later moment.
Of course that all this is imagination, but also mathematics of space and motion.

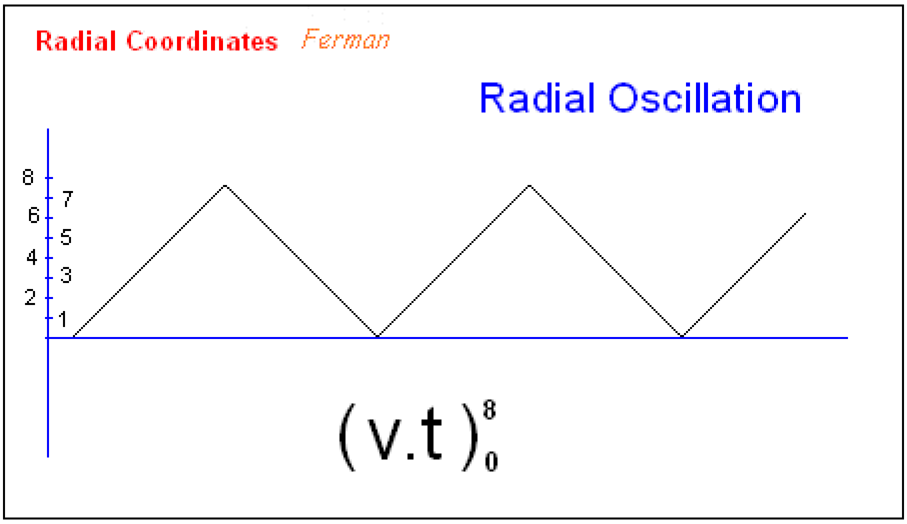


In this case, a form of application of these radial coordinates to measure could be when obtaining the volume of the pipeline: V = S. (v.t) where S is the area or aperture of the pipeline and (v.t) its longitude in each moment.

Drawing 11

Radial Oscillation

Although this is a topic that we treat lightly, it is interesting to expose its existence because it can be important to build many types of figures and geometric bodies. For instance stars, screws, etc.
The radial oscillation is simply an enclosure of a numeric succession that we choose to apply it to any parameter or radial coordinate.
Oscillation is called because the values (that we take) oscillate between a maximum and minimum value and in continuous way.
For example, if the enclosure of values goes from 1 to 5, we would apply the value first 1, later the 2, 3, 4 and 5 and when arriving to this value (5) we would return down in contrary sense to 1 where we ascend again and so forth.
Therefore a succession of this type would be 1,2, 3,4,5,4,3,2,1,2,3,4,5,4,3,2,1,2,.... etc.
As we see this method of application of values would form a wave in a drawing of coordinates.
To express a radial oscillation we can add indexes with the maximum and sub-indexes with the minimum value of the oscillation.
In the drawing we can see an example of radial oscillation that goes from 0 to 8, later from 8 to 0 and so forth.
We also see a form of expressing these radial oscillations.

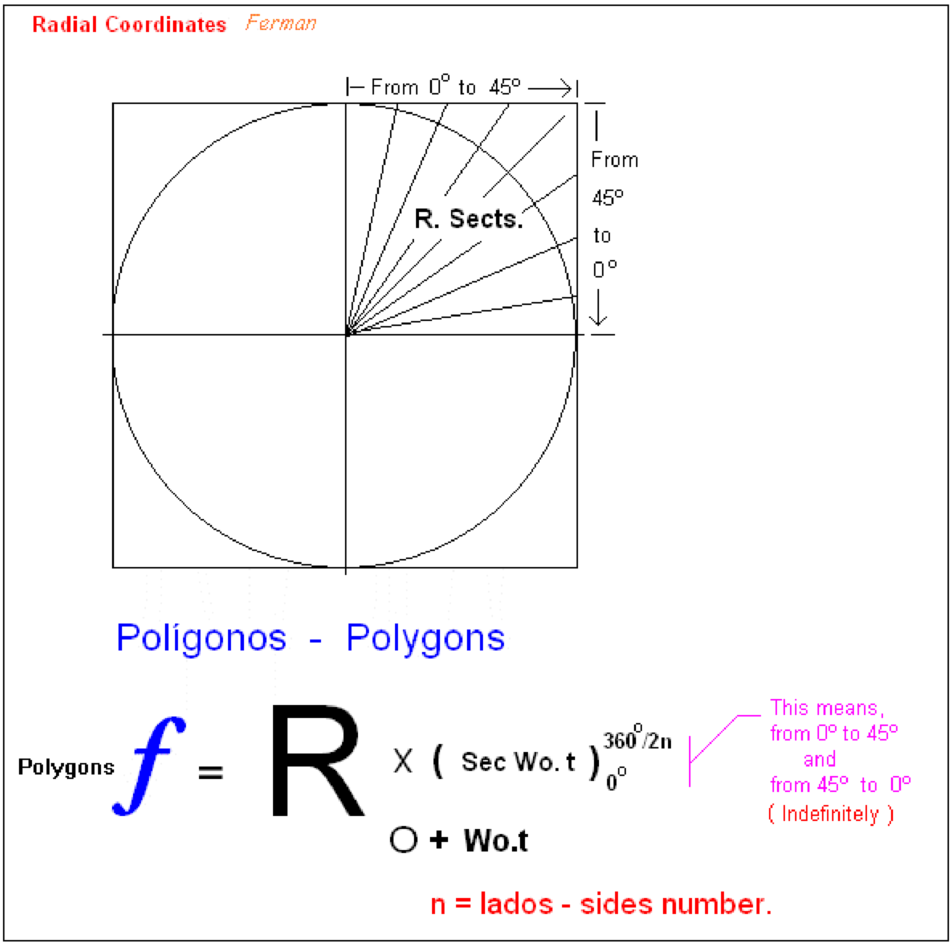


Drawing 12

Polygons, polyhedrons, screws, stars.

One of the applications of the function of radial oscillation is for building polygons. And enlarging the formula a little, the one of drawing other types of figures as polyhedrons, screws, stars, etc.
I will put on a simple formula of application in the construction of polygons, to which will be

been able to add all type of parameters to get other figures.
As this it is a easy explanation, we see the basic formula.

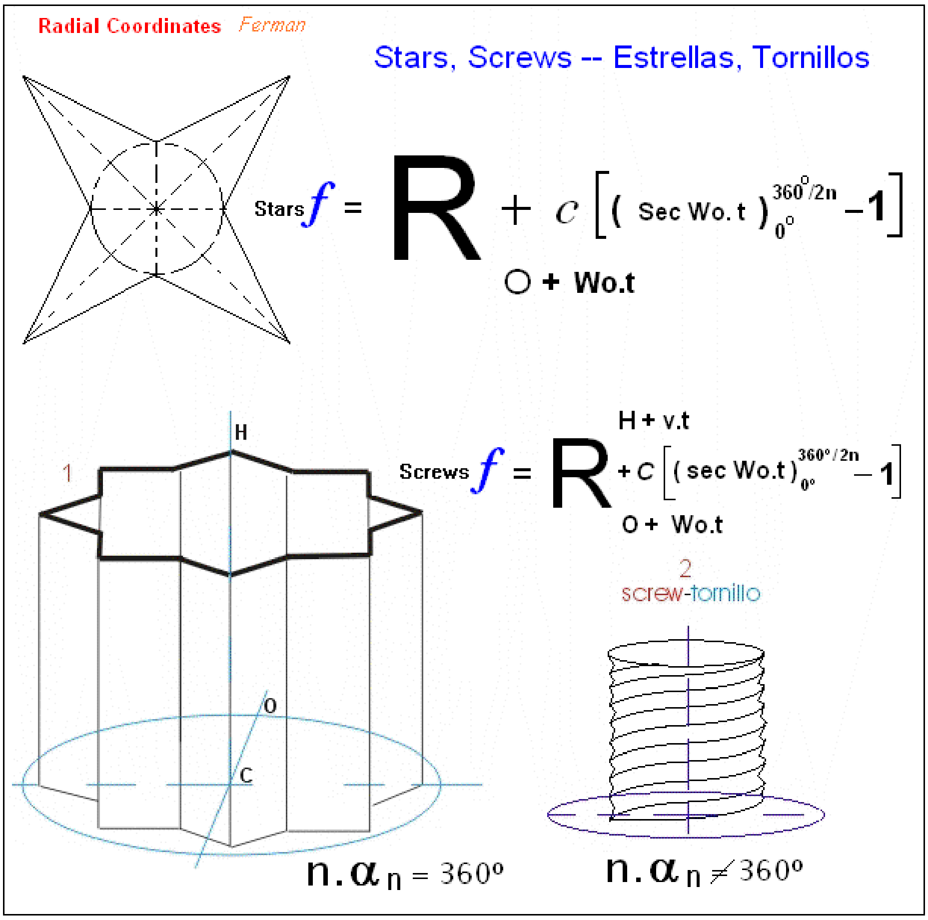


Drawing 13

In this formula we see that a direct relationship between the angular speed Wo of the horizontal coordinate O and the increase of the radius exists.
This way the speed Wo that we give to the coordinates is independent and not affect the structure of the figure.
Explanation of the parameters of the formula.
---We already have seen and we know as the horizontal coordinate O and its angular speed Wo work in other formulas.
--- The appropriate increase of radio, in coordination with the horizontal coordinate O of rotation, it is given by the parameter R x (sec Wo . t) from 360/2N to 0 degrees.
This means that, to the value of the angle that goes acquiring the O coordinate with the time t in each moment, we have transformed into a vector of oscillation in such a way that when the value of the angle arrive at 45 degrees, it begins to lower in the same proportion and speed until 0 degrees, where it ascends again at 45 degrees and so forth, as an oscillation wave.
It is similar to that we make with in trigonometry with we get a complete turn, that is to say, when we arrive at 360 degrees the value returns to 0 degrees and another count begins.
In this case, (non repetitive counting, but in oscillation way) and defined in width according to the angles or number sides, is how we can build polygons.

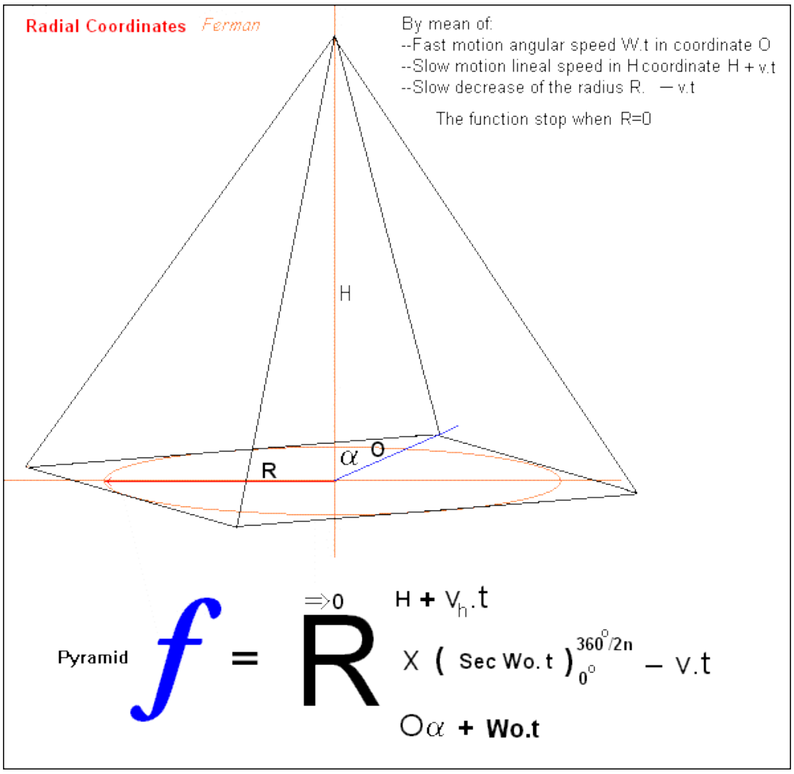
Polyhedrons, stars, screws. Drawing 14

With similar formulas that we use to build polygons, we can also build other types of figures as figures in star's form, polyhedrons, screws, etc.
As we see (drawing 14) the construction in stars' form is similar to when we build regular polygons, but using the C constant to be able to get in the stars picks the longitude that we want. This way we can make shorter picks that in the polygons, or if we would, infinitely longer.



Polyhedrons

For the construction of polyhedrons we use the H coordinate as motion vector to give projection and motion to the base (that could be a polygon, star, or another figure) upward and to get this way three-dimensional figures, as in the examples of cylinders, cones, etc.
As we know, to the horizontal coordinate O we give it high speed and to the vertical coordinate H we give it low speed to get that the figures will be compact.



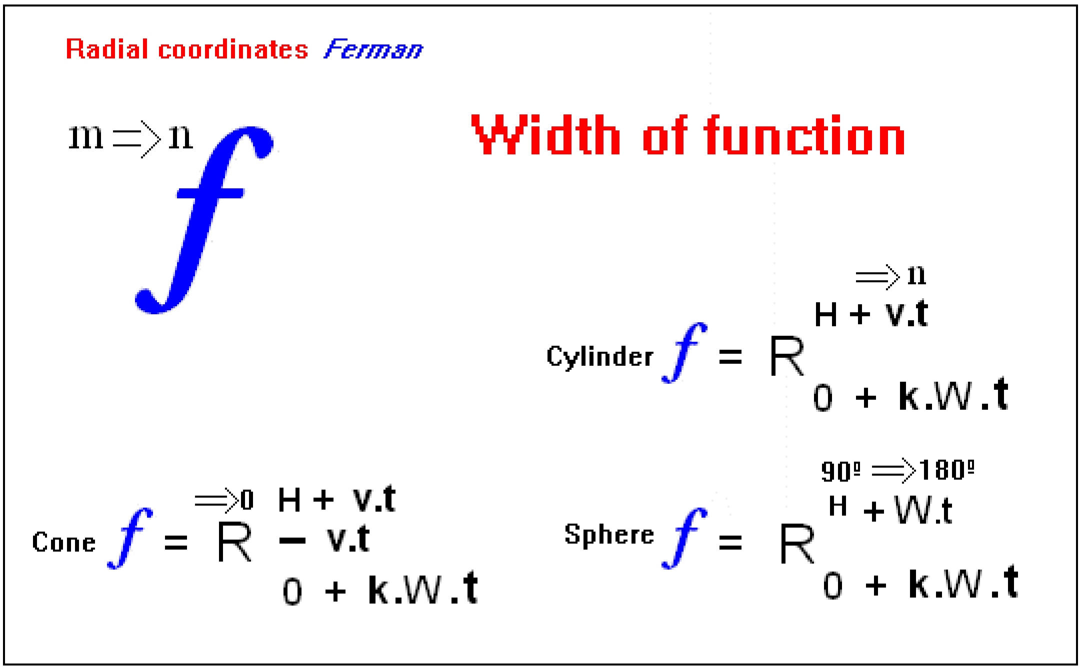
Drawing 15

Screws

To get the screw form we have to make that the sum of angles of the polygon or stars of the base doesn't coincide with the 360º of turn of the O coordinate. This way some torsion or un-coincident phase takes place and the figure goes take screw form when the H coordinate goes advancing upward.

Width of function m => n

As it has been explained, the radial coordinates are coordinates in motion with which they need a period of time to execute the function that determines them.
To this period of time in which the function is developed and draw us the figure that we want, it is to what we call **width of function**.
For it, we use the parameter **m = > n** that tells us by means of **m** when or where the function begins to be developed, and by means of **n** when or where it finishes of being developed.
The parameter of function width will be placed directly above the parameter on which will act, in such a way that the parameter where it is placed it will become **director parameter of the function.**
This tell us that the parameter or coordinate that takes on it to the function width, will be the one that determines when or where the function begins and when or where it finishes.
This question is showed, to understand it better, in the following drawing.



In this drawing we see as to the function width we can place it above any other parameter or coordinate of the formula of radial coordinates.
-- When it is place in **f** it tell us that the time of execution of the function will begin in **m** and it will finish in **n.**
-- If in radius R (i.e. cone) it will tell us that the function finishes when the radius R is zero, that is to say, when the cone is finished.
-- Above the coordinate H=c, (i.e. cylinder) will give us the height (v.t) of the cylinder.
-- Above the coordinate H (i.e. sphere) it will tell us that the sphere begins to be developed starting from 90 degrees of H and it finishes in the value of 180 degrees of H.
etc.

The Cosmos and its radial coordinates.

The theory and proposals of this system of radial coordinates come from the necessity that I had of finding the appropriate way of solving the problem of situation of electrons in atoms and of planets in stars, according to my proposals and model of Cosmos of 1975.
Paraphrasing a little I could say that according to my vision of the topic, I could consider that:
"Los humans have squared mind and so we use the Cartesian coordinates, while the Cosmos has a spherical mind using this way the radial coordinates."
And it seems this way when all the cosmic creations try to take spiral, spherical, helical or symmetrical shapes as well as fractal movements.
While for us everything should be squared, as our way of thinking.
Because well, one of these erroneous consequences -very modern by the way- of this squared thinking has been of using Cartesian coordinates to locate electrons in their orbits in such a way that would seem grapes hanging of its cluster.
And it doesn't care if for this we have to forget all the physical knowledge that we have as for example the forces in atoms; their central gravitational fields; their also central magnetic and electromagnetic fields; that is necessary fields of attractive forces and centrifugal inertias that balance these fields, etc.
So for that reason I proposed the radial coordinates exposed in this explanation and previously in my web of 2003.
Thanks to all you. F.M.R.