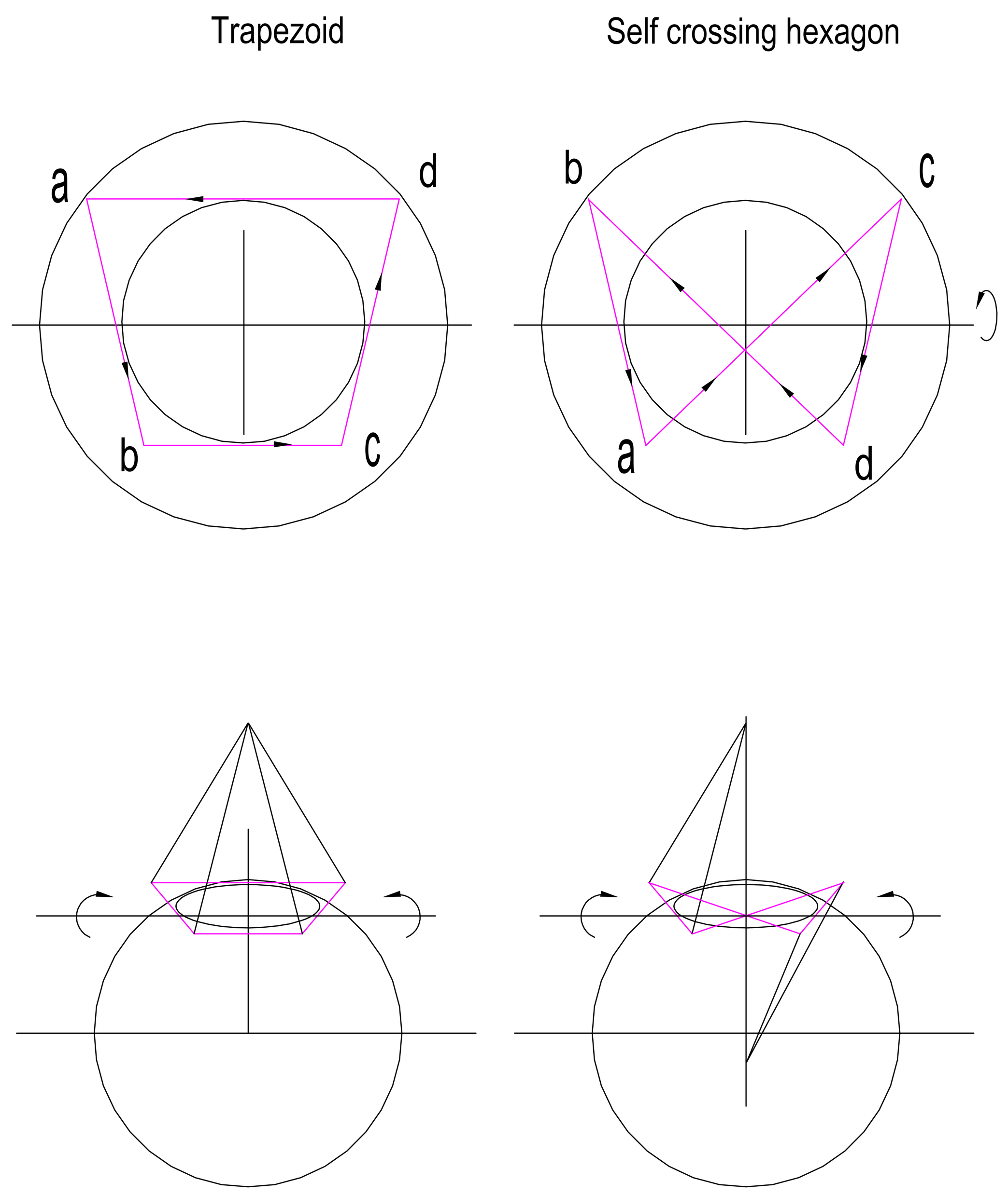
Magnetic field and Bending

Take a polygon to be an trapezoid then rotate the plane to obtain a self-crossing hexagon.
This is as if we have applied a moment along the vertical axis to twist the plane.
The original cone will be cut and its vertex will rotate 180 degrees
We will in this case have two devided cones
We can take the complete cone and its conjugate as well

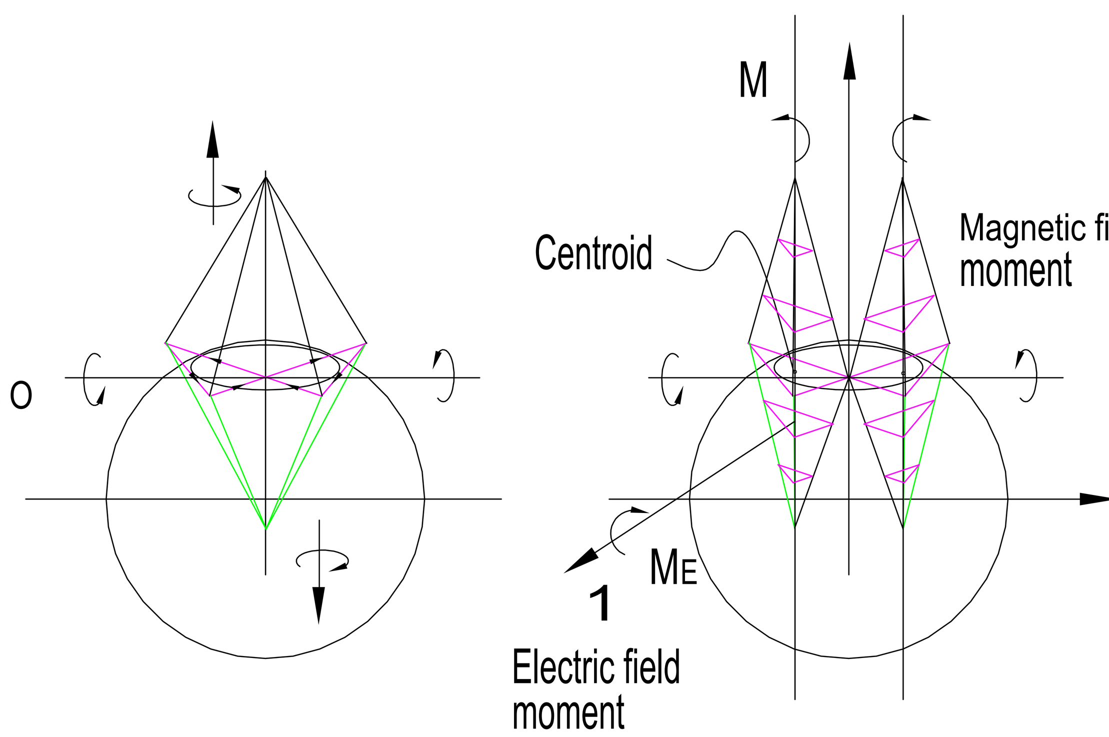


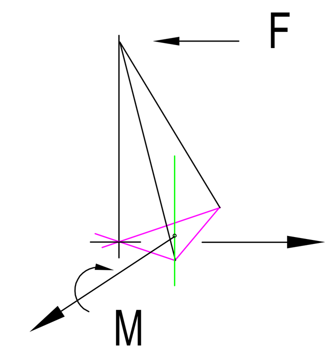
Each split cone will have its conjugate, or we have two complete conjugate cones.

Invert and expand polygon so that it is at the plane of the equator.

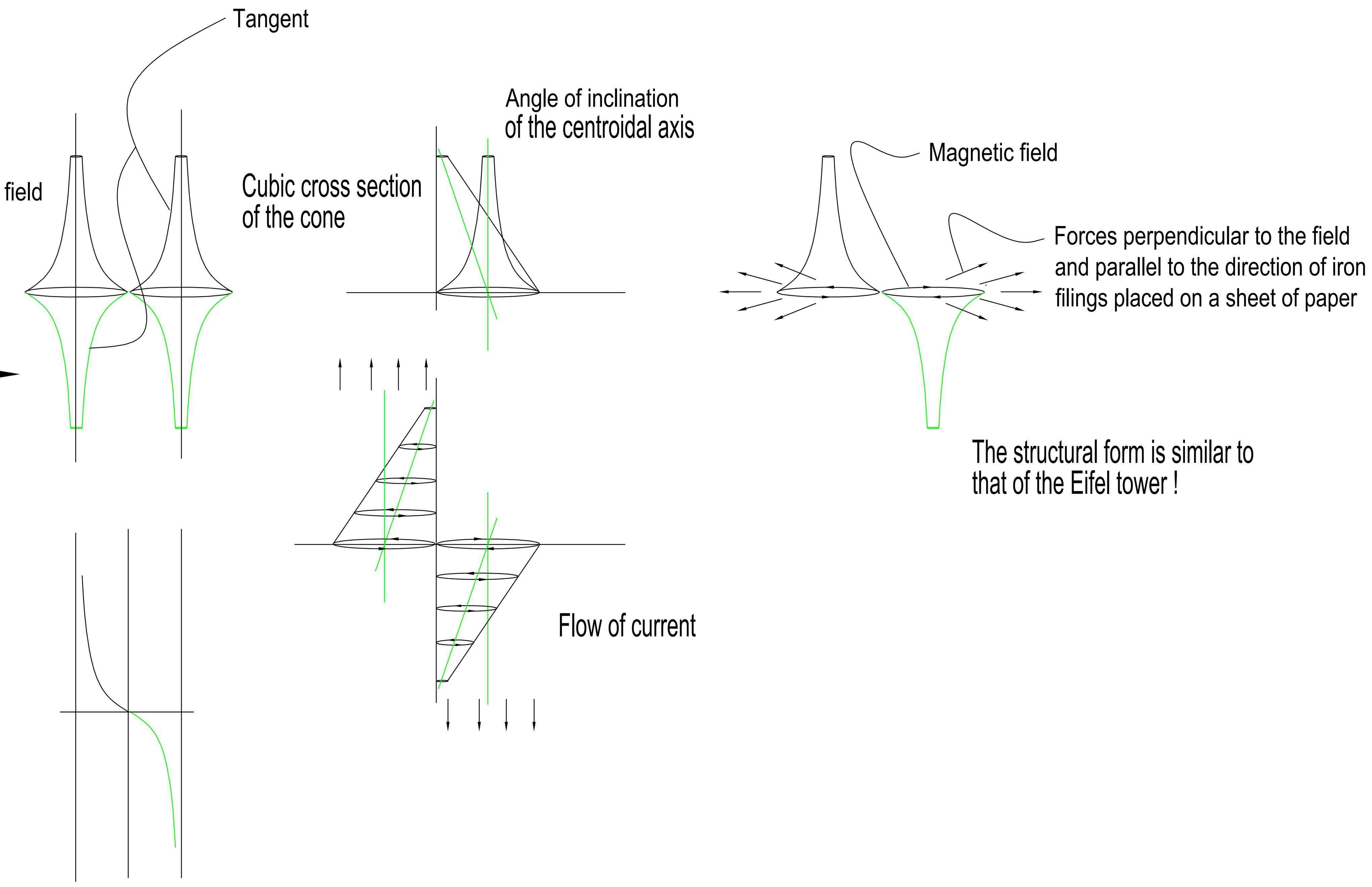
If we now flatten the cone we should end up with two vertices O and O', which are that of conjugate cones. See Graphical Statics.

Apply first moment to rotate the plane 180 degrees and obtain the crossed hexagon or crossed circle. This will provide us with two inclined cones. To separate the two triangles along the height of the cone apply moment along 1-1 axis.





The force which will separate the cones will be proportional to the angle of inclination of the centroidal axis.
The load bending the tetrahedron will be triangular distributed load and the moment diagram will be cubic in nature. Hence in order for the stresses in the cross section to be uniform the cross section will have to increase a cubically.



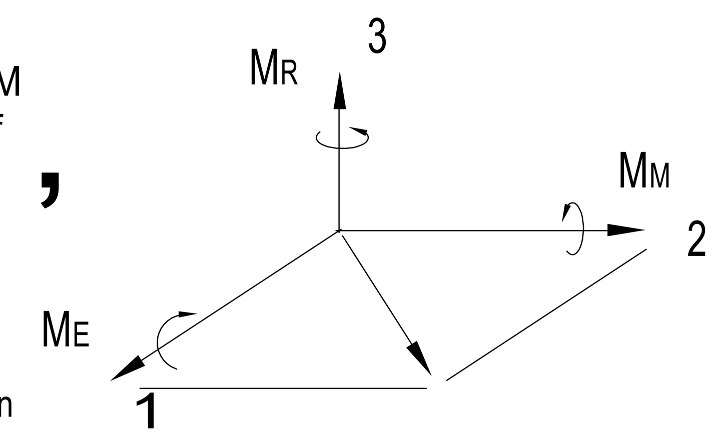
Depending on the strength of each moment, M_E , and M_M there will be an additional rotation equal to the sum of the two moments M_R. This rotation , $M_R = M_E + M_M$ corresponds to the rotation of the polygon in plan as it is expanded and moved down towards the equator.

In the presense of alternating current the sphere would rotate back and forth or 360 degrees if the current flows in a loop.

Apply to beam theory.

The reversed surface will account for the tensile and compressive forces in the beam, about the neutral axis.

The rotation of the polygons about their respactive planes is atrributed to torsion.



Lest try to describe the process step by step.
We know have the so called U tube.
What is the relation between the:
1. Rotated surface of the polygon
2. Size of the polygon
3. Stability , and column buckling!

Similar to the heptagon, any polygon can be deemed unstable with increased force.

1. If we rotated the surface 180, we obtain a twisted polygon and the U tube. What if the surface was only rotated 90 degrees? is the rotation spontaneous?
2. Does the polygon start with the Triangle and end at the Heptagon?
It makes sense that the surface rotates at the transformation of the octahedron to the cube as they are inverse of one another.

Assume the cone is one piece and take the polygon to be a Heptagon. It breaks while trying to invert itself. This is similar to the 8 degree velocity pole curve, where at 8 degrees the velocity curve develops a bump on its side.

The heptagon breaks into two Hexagons.

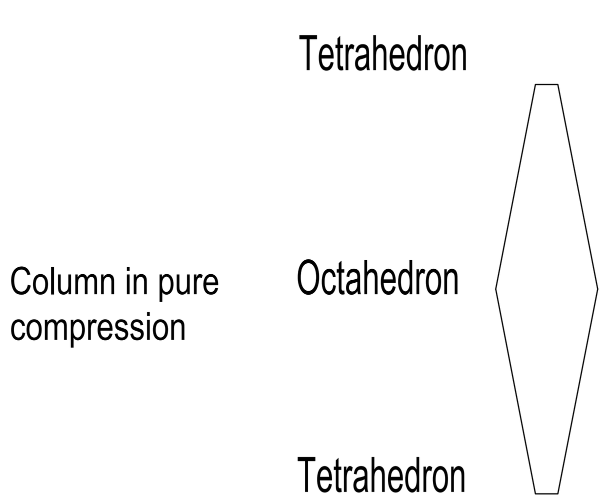
At the pentagon the polygon shrinks with inversion. So we have one inversion causing shrinkage. The other at the cube to octahedron will rotate the surface.

Move down to the cube, and we still have one cone.

At the cube to the octahedron the surface rotates 180.

Finally at the tip of the psudosphere, we have the tetrahedron.

We have two rotations - rotation of the plane (Octahedron to the Cube) and reversal of spin the pentagon to the hexagon. As the plane starts to rotate the spin decreases and eventually would come to a stop if the plane did not pass the 90 degree mark.

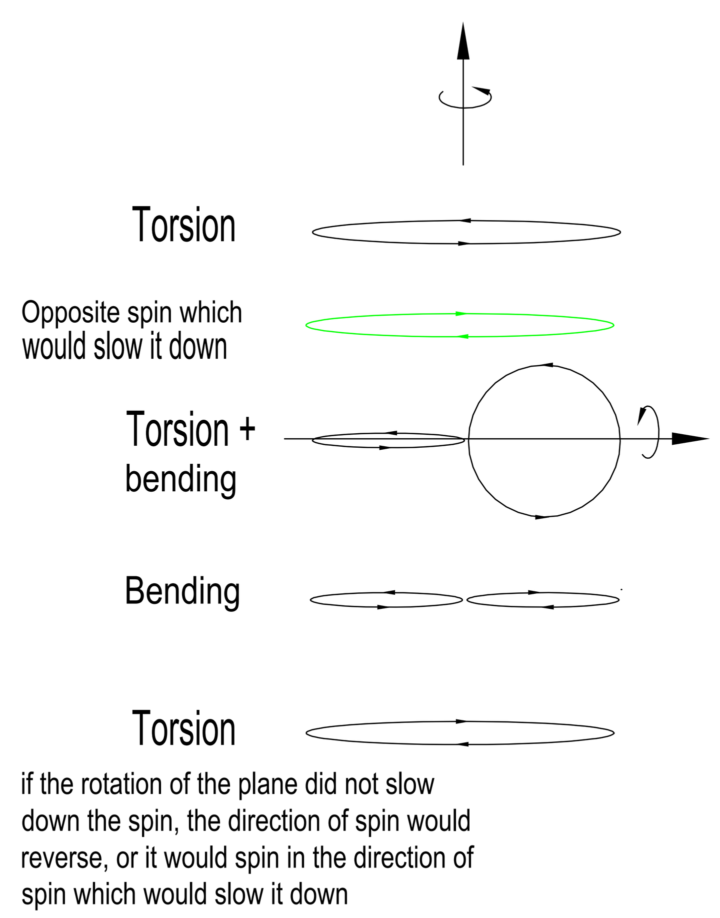


The right hand plane rotates, up to 90° degrees slowing down the spin to a complete stop.

If it is able to rotate passed the 90° point, the spin will reverse itself.

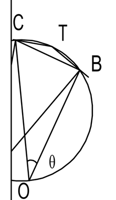
Does the reversal of spin cause the plane to rotate or does the rotation of the plane cause the reversal in spin direction. Is this process spontaneous?

if a column is restrained against torsion and bending, then we will have pure compression. We would then go from the tetrahedron down to the octahedron and move straight down back to the tetrahedron, withouth reversal of planes or spin.



Loxodormic transofrmation - Bending and Torsion
Interior of the torus not shown

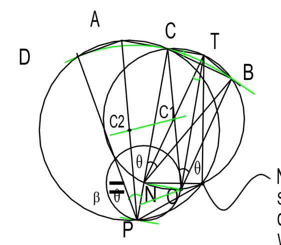
The "Eye" of the Hurricane and the Heptagon



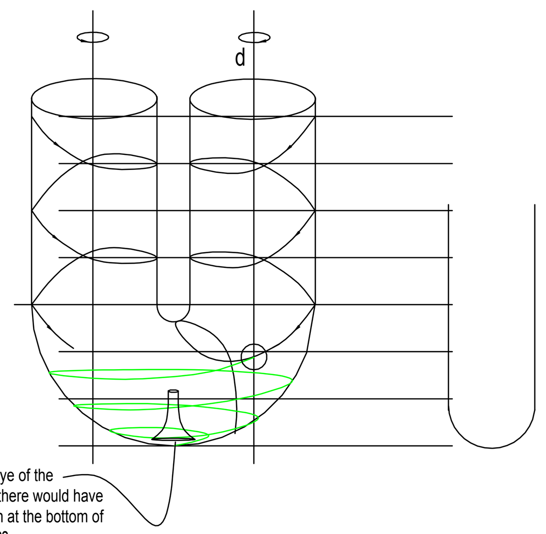
To track the movement of the eye
Keep the angle at ±8°, and move the eye at constant interval, in order to have enough energy to go up the tube.
The angle between the top chords should be 26.5 to 30° degrees.

The eye of the hurricane, O, moves in a circle. Depending on the angle, we can be at regular or quantum speeds.

N O O

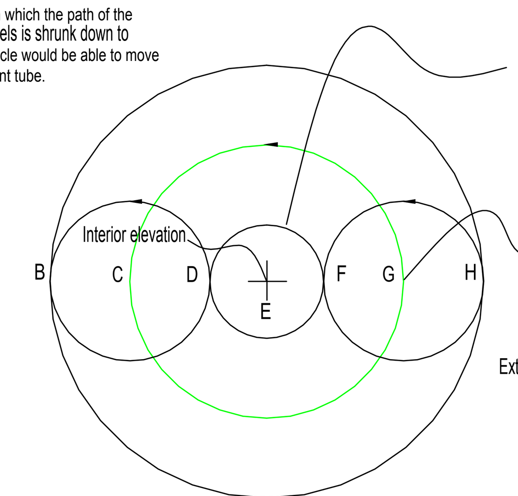


New location of O
Say the location of O is not constant and there is an error in our observation.
We can increase CN by ON for only two more tries, after which we will have to keep moving the location of O.



In order to keep the eye of the hurricane stationary, there would have to be an opposite spin at the bottom of the tube. See umbilics

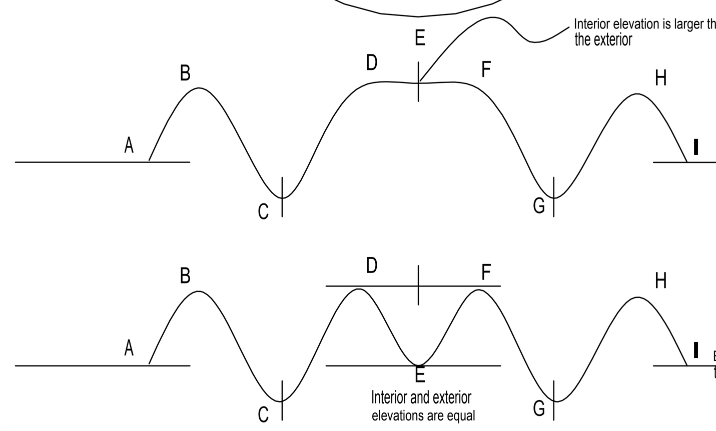
If the circle on which the path of the hurricane travels is shrunk down to zero, the particle would be able to move up the adjacent tube.



Depending on the size of the inner circle/spiral there would be a difference in the internal and external energy or elevation

Path of the eye of the hurricane

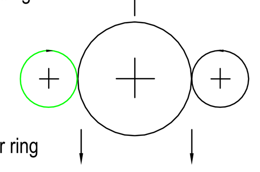
Exterior elevation



Cross section

In the case of one ring - figure 8

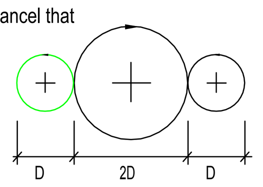
Vertical force resisting to keep the ring from falling



Vertical force on the interior ring

In the case of one ring with surface rotation

Clockwise rotation required to keep the ring from falling
Rotation of the inner ring will cancel that of the outer rings

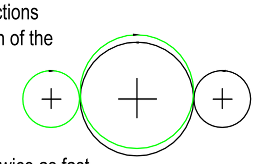


Zero force on the interior ring

In the case of two rings at the equator

The sphere is split so we have two rings at the equator. In total, for the torus, we have two split spheres, one for the upper half and one for the lower half.

Each of the interior rings will spin in opposite directions balancing the rotation of the exteior rings

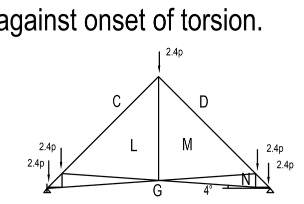


Each exteior ring will spin twice as fast as the interior ring

Rotational equilibrium is still maintained if the two interior spheres are rotating at half speed.
Take one sphere for the upper half torus and one sphere for the lower half. The mass of each sphere is then one half.

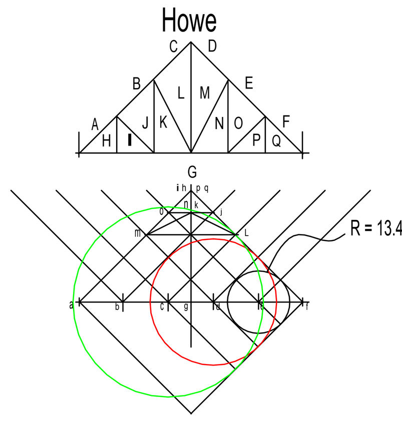
This scheme has the added advantage that, in all four quadrants of the torus, if we were to attribute to the rings torsional and bending characteristics, then by varrying the spins while maintaining equilibrium by changing the size of the rings we can directly calculate the effect of each.

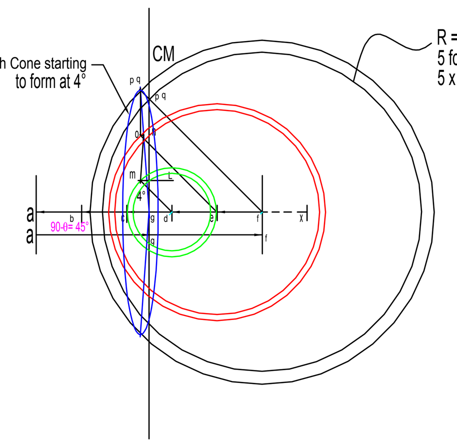
5 fold energy increase. 67.75/13.4 = 5.0
Factor of safety against onset of torsion.



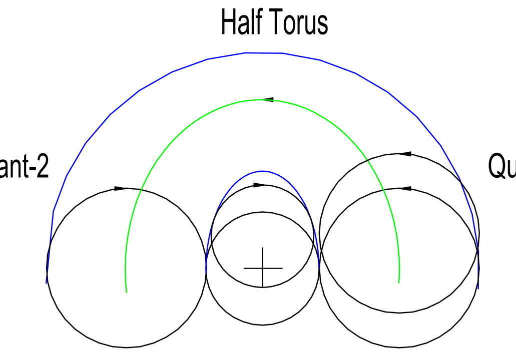
Mach -1 4°

Howe





Half Torus



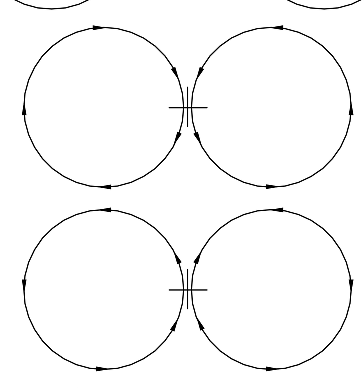


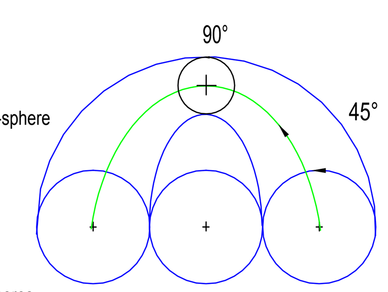
Figure 8

The plane of the equator rotates 180° /inverts itself, and starts spinning the inner sphere

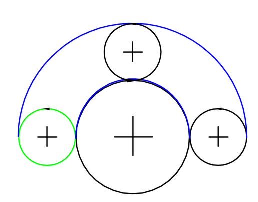
The avboe figure shows the rings as they would travel around the torus. In the second figure, if one of the surfaces, say the one on the left, was to reverse (invert) itself, (when the interior ring is equal to zero and we are at the top pole of the interior sphere) then both rings would rotate in the same direction. The rings on our inteior sphere would then have to rotate in the same direction.

The two rotations of the rings on the outside face of the half torus/donut will cancel with the rotation of the interior ring for equilibrium. In that case the interior sphere will remain fixed at the equator. With the rings on the equator of the inner sphere stationary, if we continue to rotate the interior sphere we obtain geodesics on the sphere which are curved.

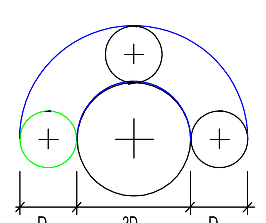
Project this on the complex plane. This is refered to as loxodormic mobius transformation.



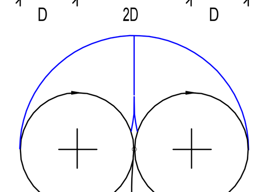
Take the average as the three sphere and the two exteior spheres rotate and decrease in size



Final 3-sphere decreases in size to a 2-sphere

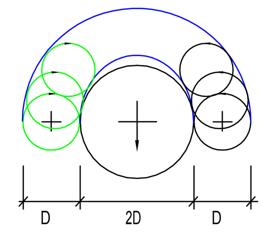


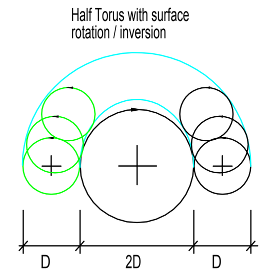
Now consider the U tube, where our middle sphere will rotate and decrease in size to zero, while the system is in equilibrium. The top figure three sphere will transform into a two sphere. The two exteior spheres will form the two sphere while the middle sphere reduces in size to zero.

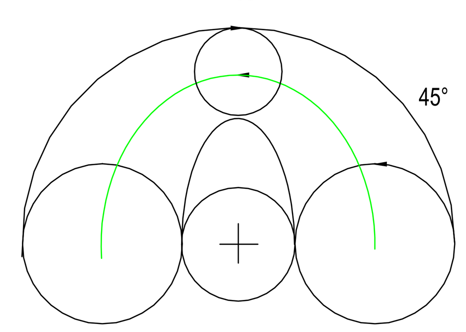


Middle sphere goes to zero

The sphere inside the torus would have to be twice the sphere inside the tube if the spins are equal







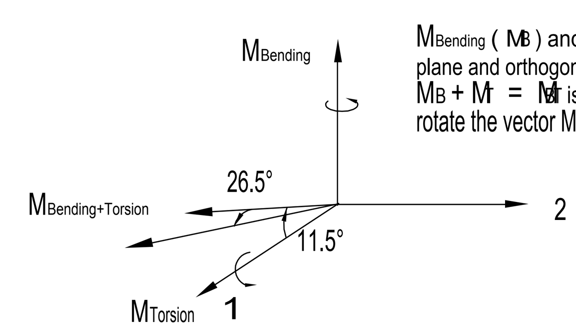
Calculate the total twist in the sphere to the right as it rotates to the top of the torus. For simplicity we will take the average as follows:

We know that our sphere to the right rotates 90 degrees and its size decreases to 1 /4 of its original size.

From zero to 45° the sphere is 1 /3 the three sphere hence it rotates 1 /3 of 45° to get to 45°. 1 /3 of 45 = 15°.
From 45 to 90° the sphere rotates another 45 / 4 = 11.5° for a total of 26.5° degrees.
This is the twist on the surface of the torus.

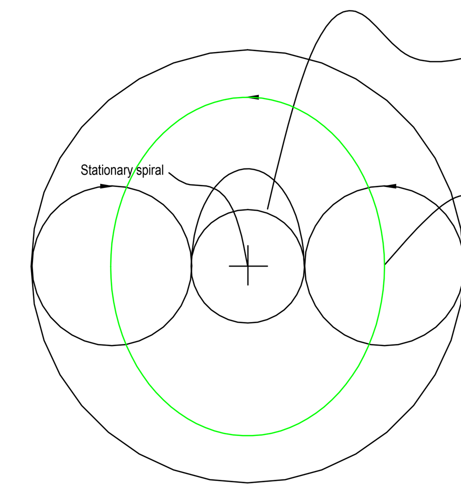
We can show this on the truss and and the sphere get the total rotational energy as our three sphere rotates 26.5°.

For both twist and compression and/or tension our rays would be at 34° degrees and we still have our bottom chord which we have associated with torsion at 26.5°, but now our three sphere has decreased in size due to the compression.



MBending (MB) and MTorsion (MT) are in the same plane and orthogonal to one another.
MB + MT = MBT is also in the same plane. Next we rotate the vector MBT by 26.5° about the 1-1 axis.

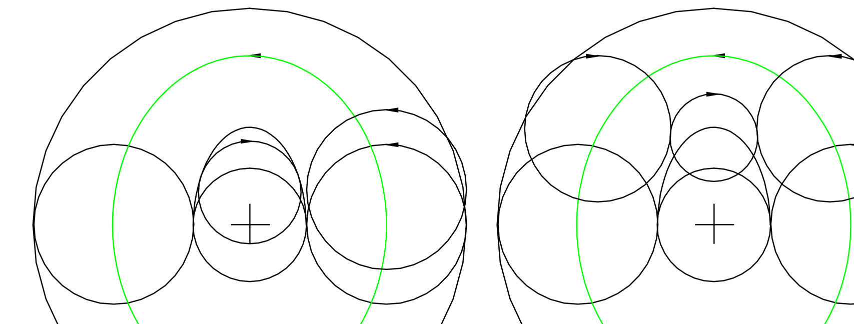
Take the plane of the earth away and obtain the doughnut.

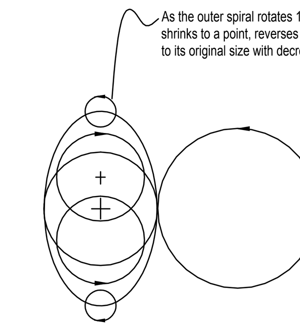


The inner spiral would be stationary (without spin) at the center of the donut, the spin would be opposite to that of the spiral in the inner tube. The inner spiral spin would then reverse itself at the inner boundary

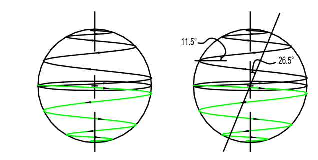
Path of the eye of the hurricane

Exterior elevation





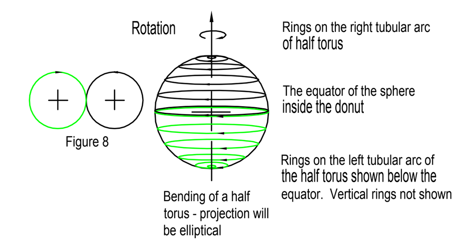
As the outer spiral rotates 180 the inner spiral shrinks to a point, reverses its spin, enlarges to its original size with decreasing spin.

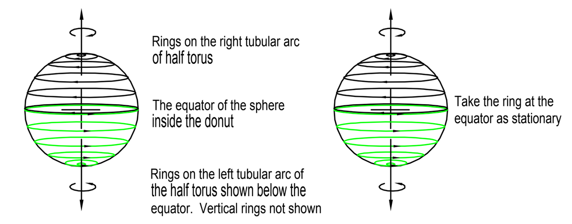


Bending and torsion of a half torus - projection will be loxodormic

Take the sphere inside the torus - plan view shown.
The rings on the sufrace of the torus represent the field.
The rings on the sphere are proportional to field strength of on the torus.
If it is assumed that the rings of the torus are stationary at the equator, then this would fix the ring at the equator causing torsion in the sphere.

The rings on sphere below represent pure bending without torsion. The rings above the equator are proportional to the rings on the right of the donut or torus and the rings on the left to the rings which are shown below. Hence the sphere is actually made up of two spheres.





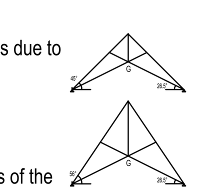
Take the case where the surface reverses and associate it with bending. In other words, for bending if our interior and exterior spheres are to remain in equilibrium the surface would reverse and both exteior spheres would rotate in the same direction whereas our interior sphere would rotate in the opposite direction of two exteior spheres. So we take a single inteior sphere and balance it with two exterior spheres half the size. We still do not know how much the spheres twist, but this would be the case of torsion plus bending compression or tension.

Take the case where the surface does not reverse. We have two interior spheres which will have to balance two exdteior spheres of equal size. This would be the case of pure torsion.

For each case draw the rays.

Hence our 3-sphere, and 4-sphere, comresses due to bending, decreasing in size, and rotates due to torsion.

For the constant M, our truss will have its top chord rotate from 45° to 56.5°.



The advantage of this method is that it is practical as it provides with the rotation of the planes of the 4-sphere separately.

The ultimate factor of safety of anchor bolts for tension and torsion is taken as 8.

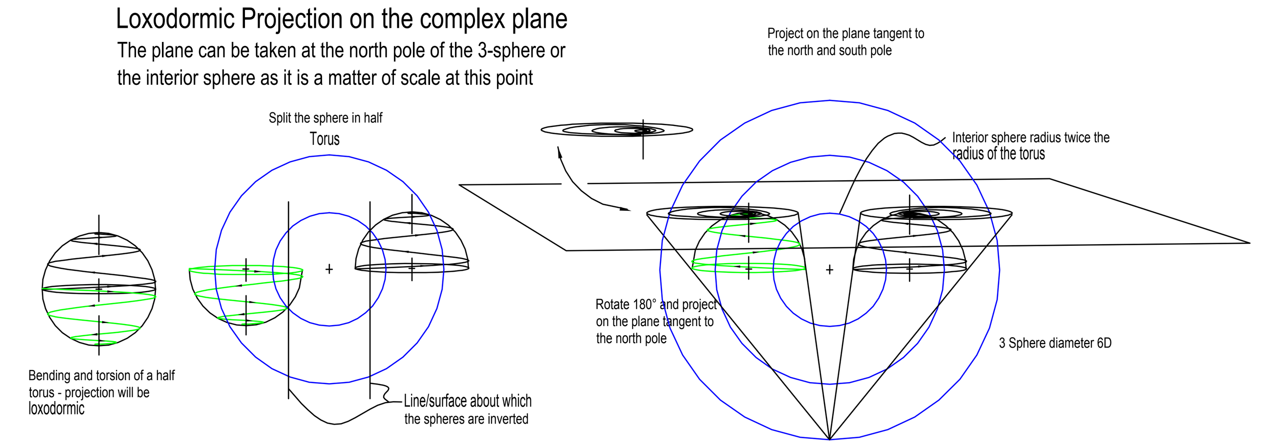
We had calculated the factor of safety against torsion as 5, that is when the truss first starts to buckle from the Pratt truss to the scissors trus.

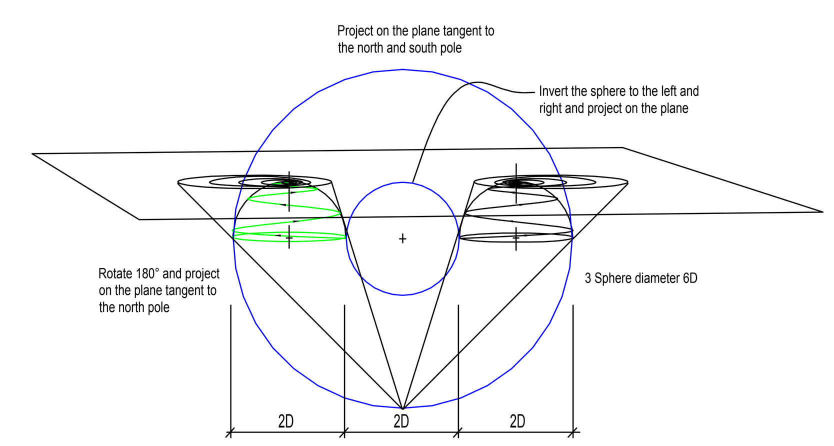
Here we have now calculated the factor of safety of bending as the ratio: 26.5/11.5 = 2.3 . Adding these two together will result for a total of 5+2.3 = 7.3 as a factor of safety. We increase this to 8 to be on the safe side. 7.5 would have been ok as well.

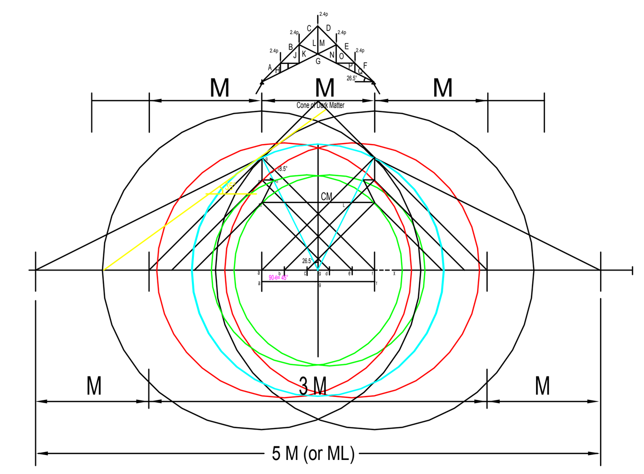
Also we note that maximum size of the four sphere = 2 C1 / cos 30 = 2.3 . See next page.

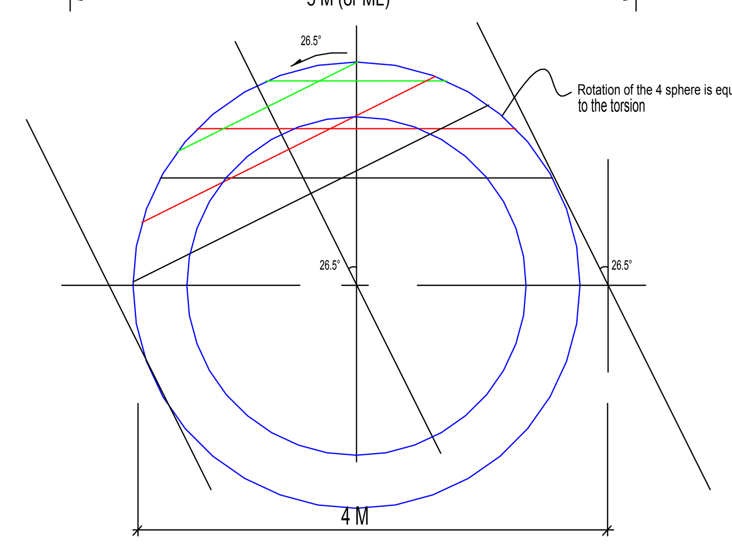
Loxodormic Projection on the complex plane

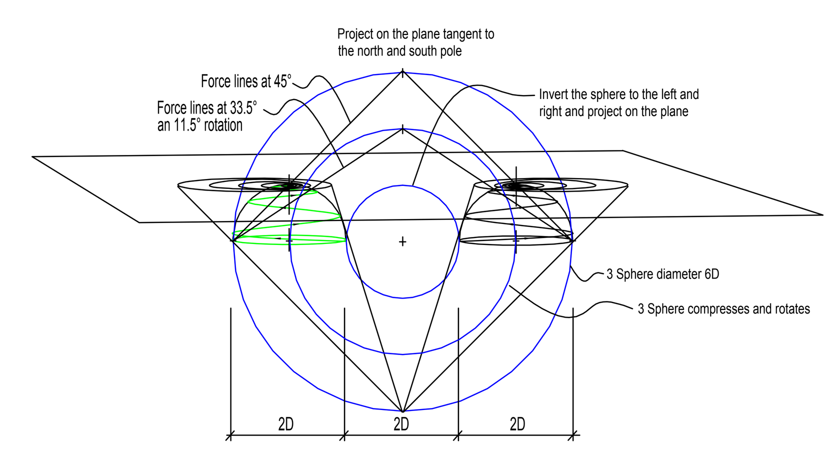
The plane can be taken at the north pole of the 3-sphere or the interior sphere as it is a matter of scale at this point











Loxodormic transofrmation / spiral

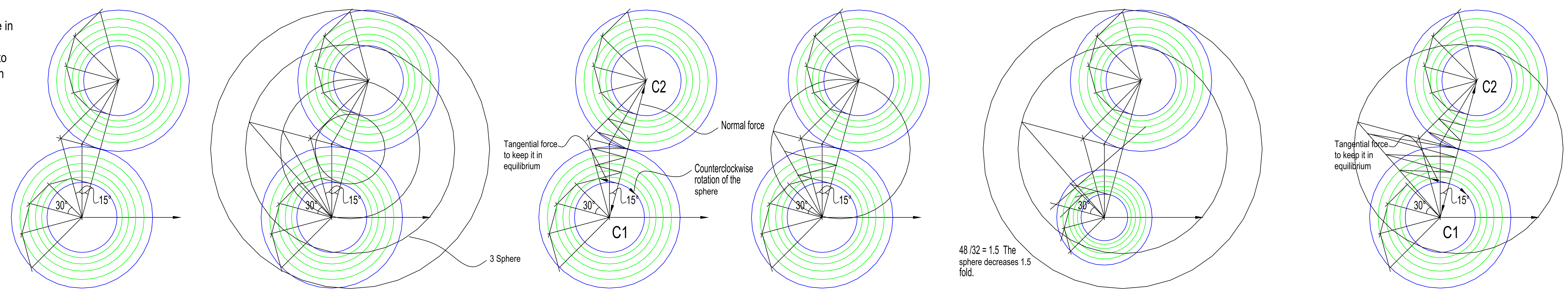
Centripetal and tangential forces of the Pratt Truss and the forces of attraction between the two spheres centered at C1 and C2.
For equilibrium, one sphre would rotate in one direction while the next in the opposite direction.
As we try to separate the two spheres, the force of attraction between them grows according to the diagram below.
If the bottom chord was raised to form the scissor's truss, the normal forces would not be colinear, hence there would be an additional rotation to line up the normal forces.

Varry the top chord of the angle and the two spheres and the attractive/repulsive forces decrease in size proportionally.

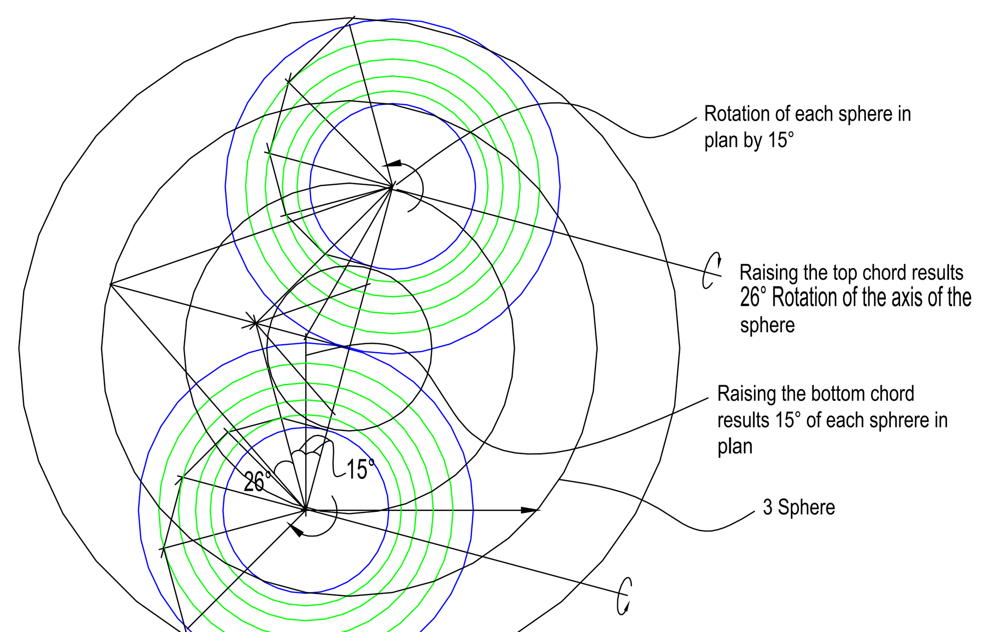
Draw the equiangular spiral in plane.
Lets take a 2:1 spiral with and angle of 30° and rotated 30° (15°). Note in this case the angle of twist of 30 degrees is twice the angle of bending plus twist of 30°. (note: the ratio does not quite equal 2 :1 for this ratio to hold the angle of rotation should be 26.5°, else there is a 13.1% error in calculations)

Rotate vertical axis in plan -15° degrees and start the spiral

In our case the angle of rotation is 26.5 instead of 30° and our angle of rotation is 11.5 instead of 15°.

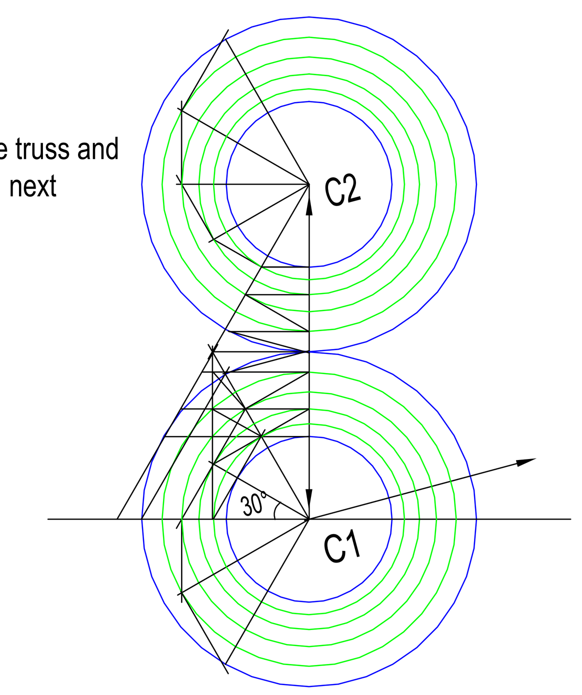


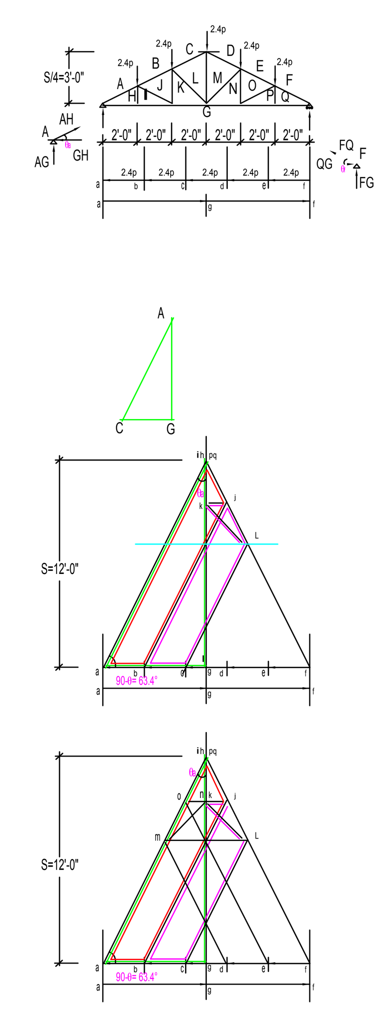
When we rais the top chord, in essense we rotate each sphereso that the center of the spheres get closer. The axis of the sphere has been rotated 56-30 = 26 degrees



Construct the Pratt truss forces from the four sphere

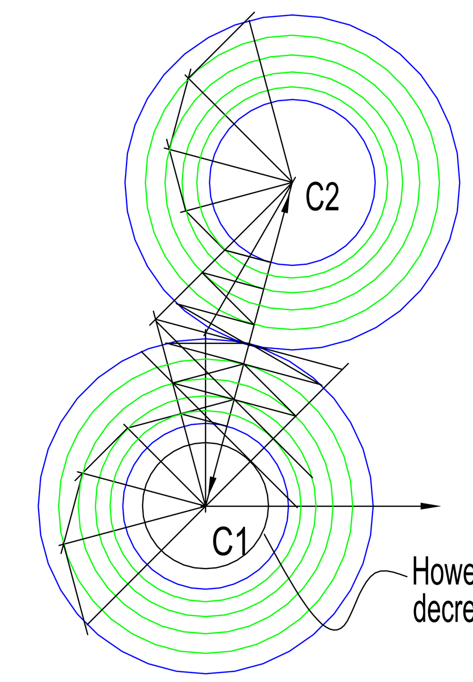
Identify the joints of the truss and delete unwanted rays. next connect the joints.





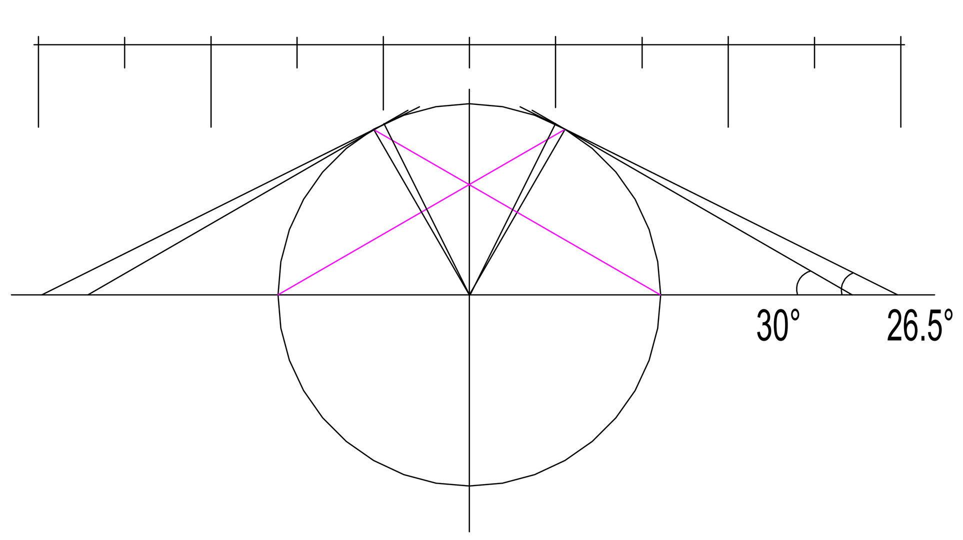
For the Howe truss mirror the spiral and perform the same.

Howe truss is less efficient.

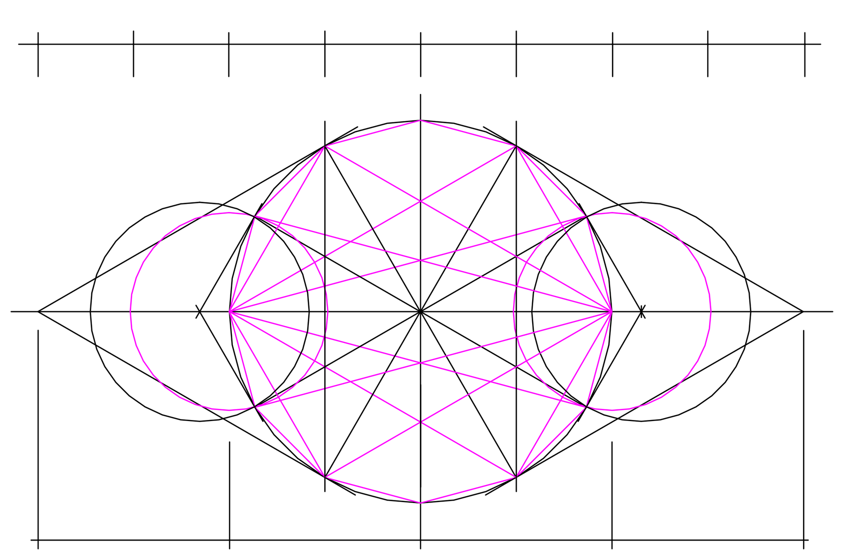


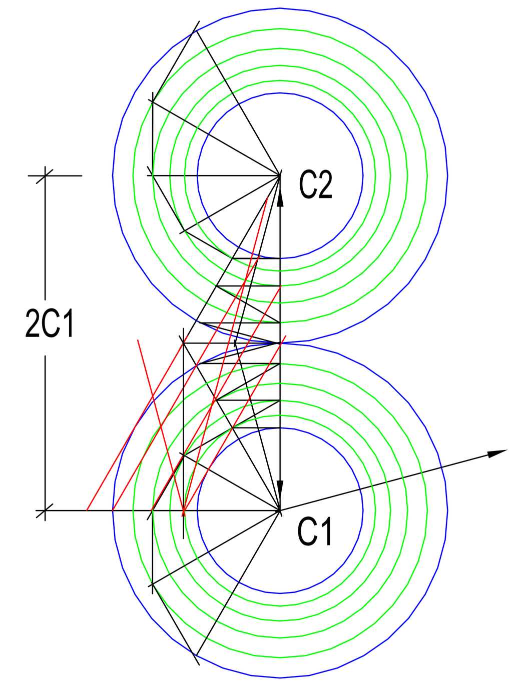
Truss structure at 60°. Force lines at 30° mass fluctuation from 26.5° to 30°

From 4 x span to 5 times span



From 4 x span at 30°

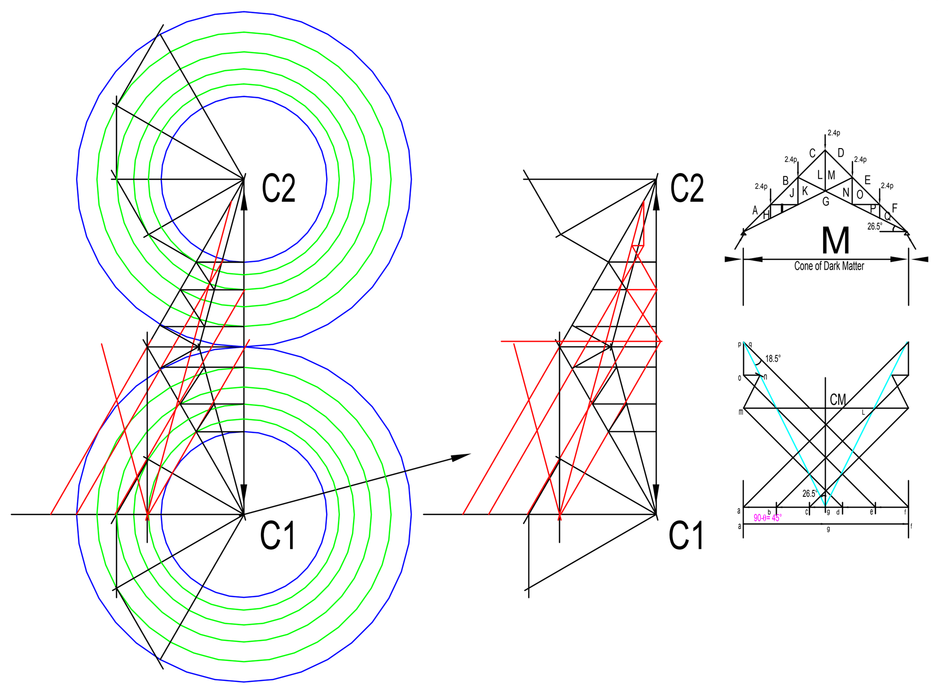




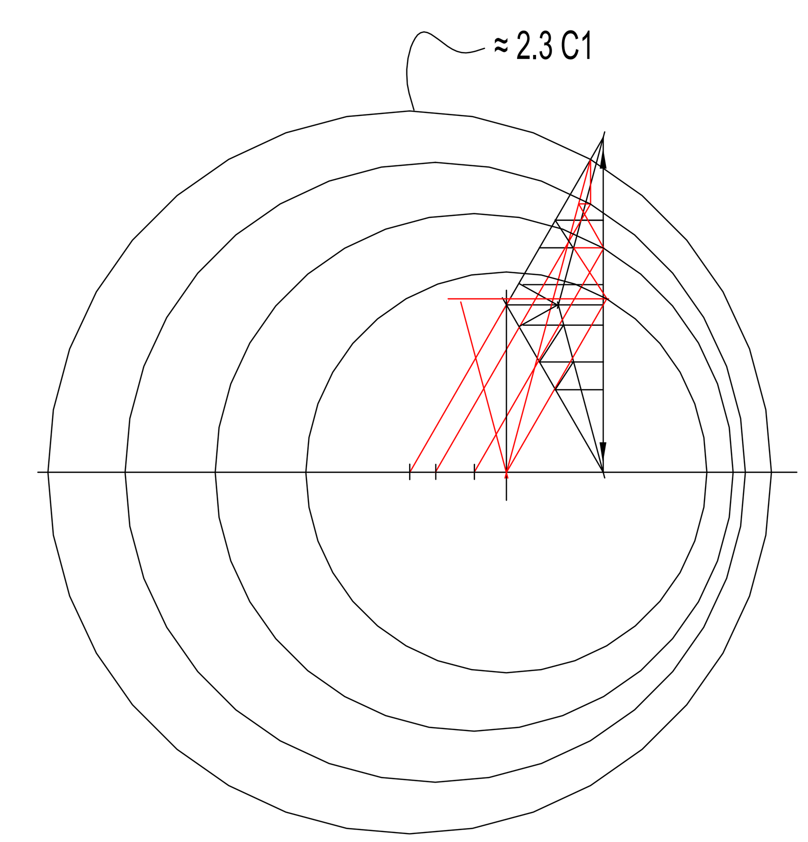
To form the Scissors truss from the Howe truss, since we have rotated the truss 15° degrees and raised the bottom chord another 15°, the diagonals would rotate 30 degrees to form the truss structure. The tangents remain as they are.

Force of attraction between C1 and C2 equals the projection of the bottom chord force on the vertical axis.

Maximum size of the four sphere = 2 C1/ cos 30 = 2.3



Maximum sieze of the 4 sphere = 2C1 /cos 30 = 2.3 C1 . If the size is any larger, the material has broken and separated.



Confinement of columns and beams:

When matter has formed say in the case of concrete when it has gained its full strength from the liquid state, the forces are considered confined within this matter.

Hence as as we bend the material since the cross section can not twist from within it will start to twist as a rigid body. If we had liquid or gas we would see a spiral / tornado start to form from within the space considered.

Now if we brace the rigid body against this twist or torsion, then the spiral will form on the inside separating the two pseudospheres.

This is true for the tetrahedron all the way to the pentagon. The pentagon will start at the point of maximum curvature. The surface has rotated and the pentagon will want to shrink but it cant since it is confined at the exterior walls.

At this point, the shrinking forces reverse themselves opening up the two towers.

This is the stress distribution along the cross section at the ultimate strength.

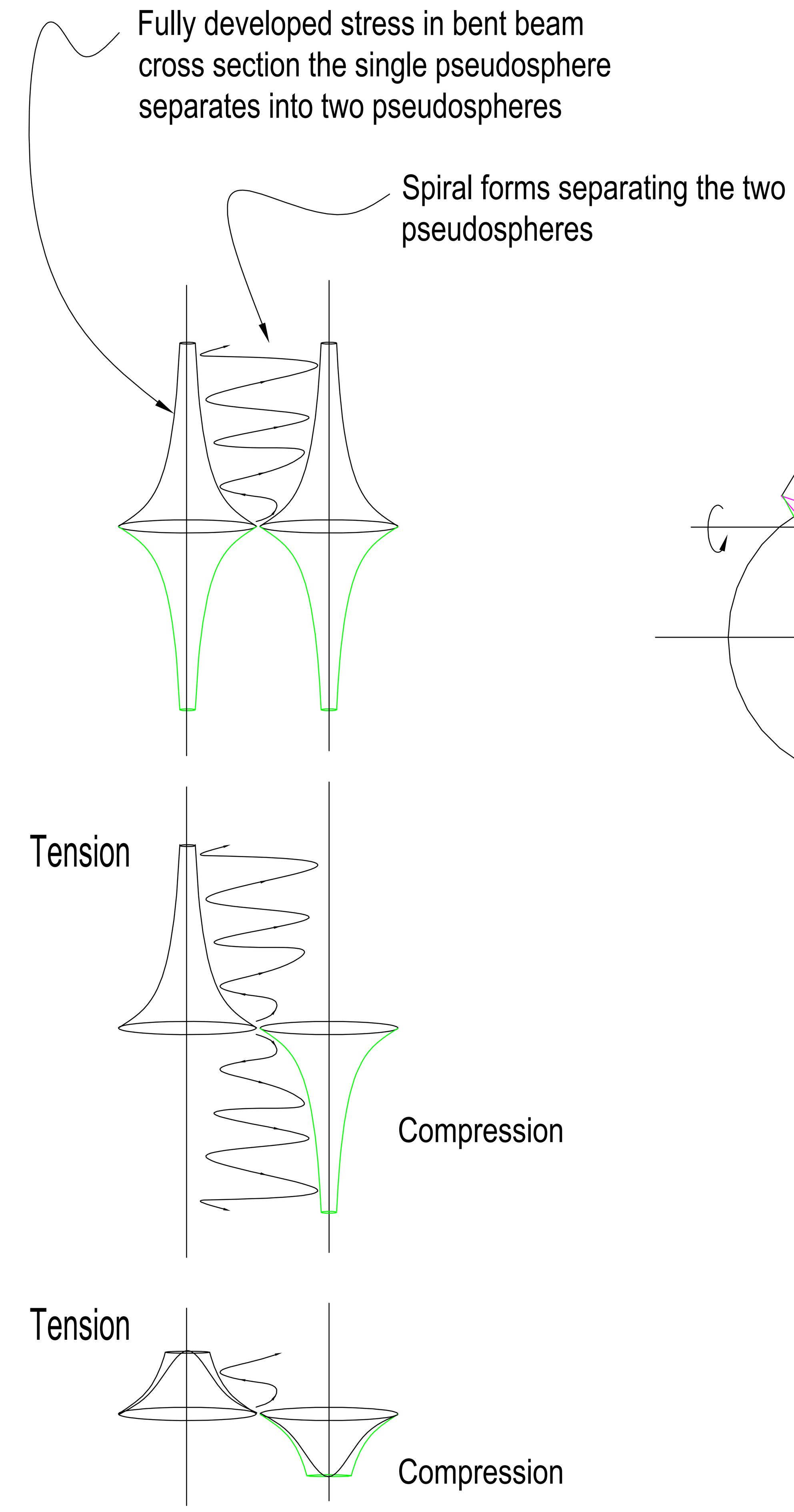
So we have two forms of twisting, one where the cross section at the onset expands as with the tetrahedron and one where it starts to shrink at the pentagon. This is what separates the the two columns. This shrinking is reversed upon confinement.

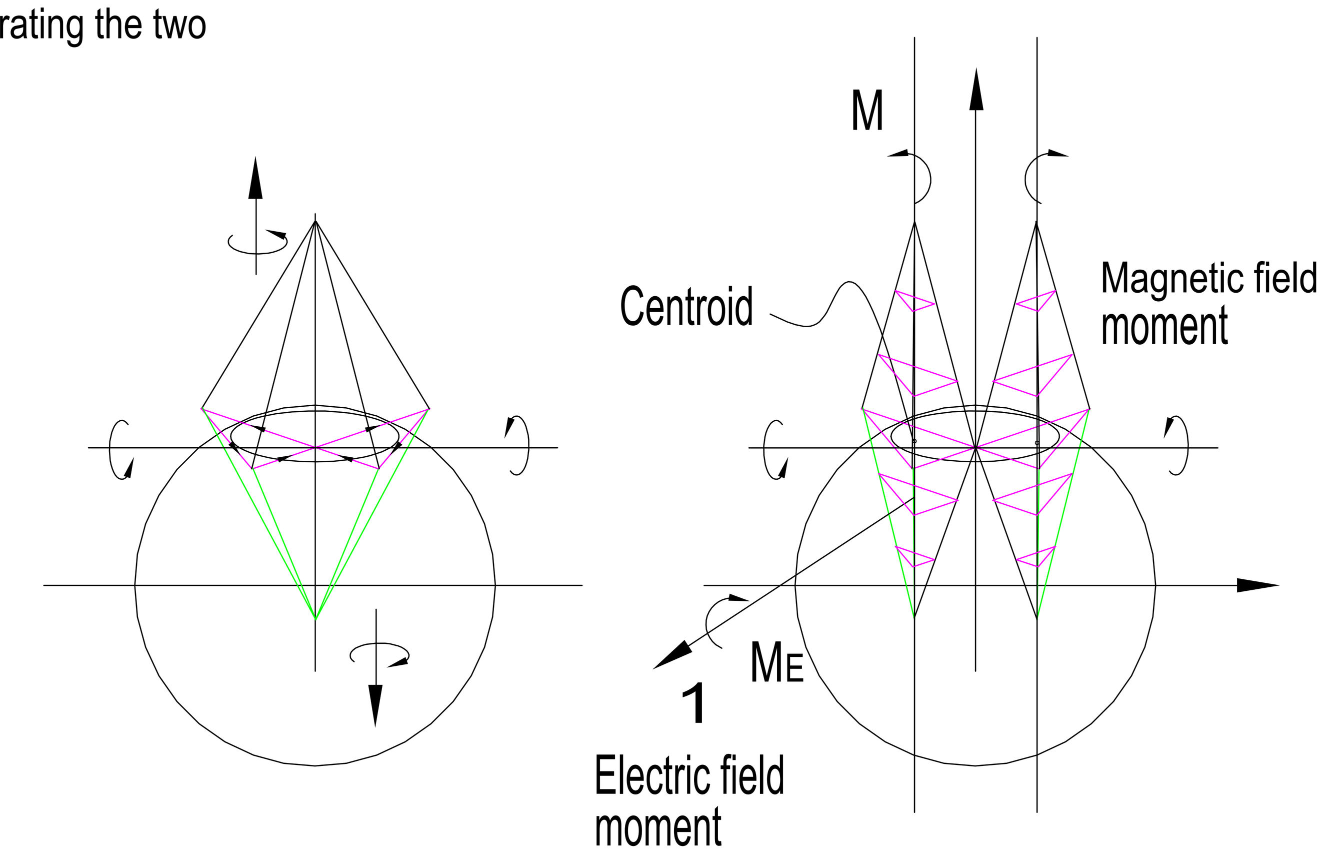
Confinement by wrapping the column will have negligible effect in its strength unless the column is assumed to be bending. Hence wrapping the column will increase its lateral force resisting strength.

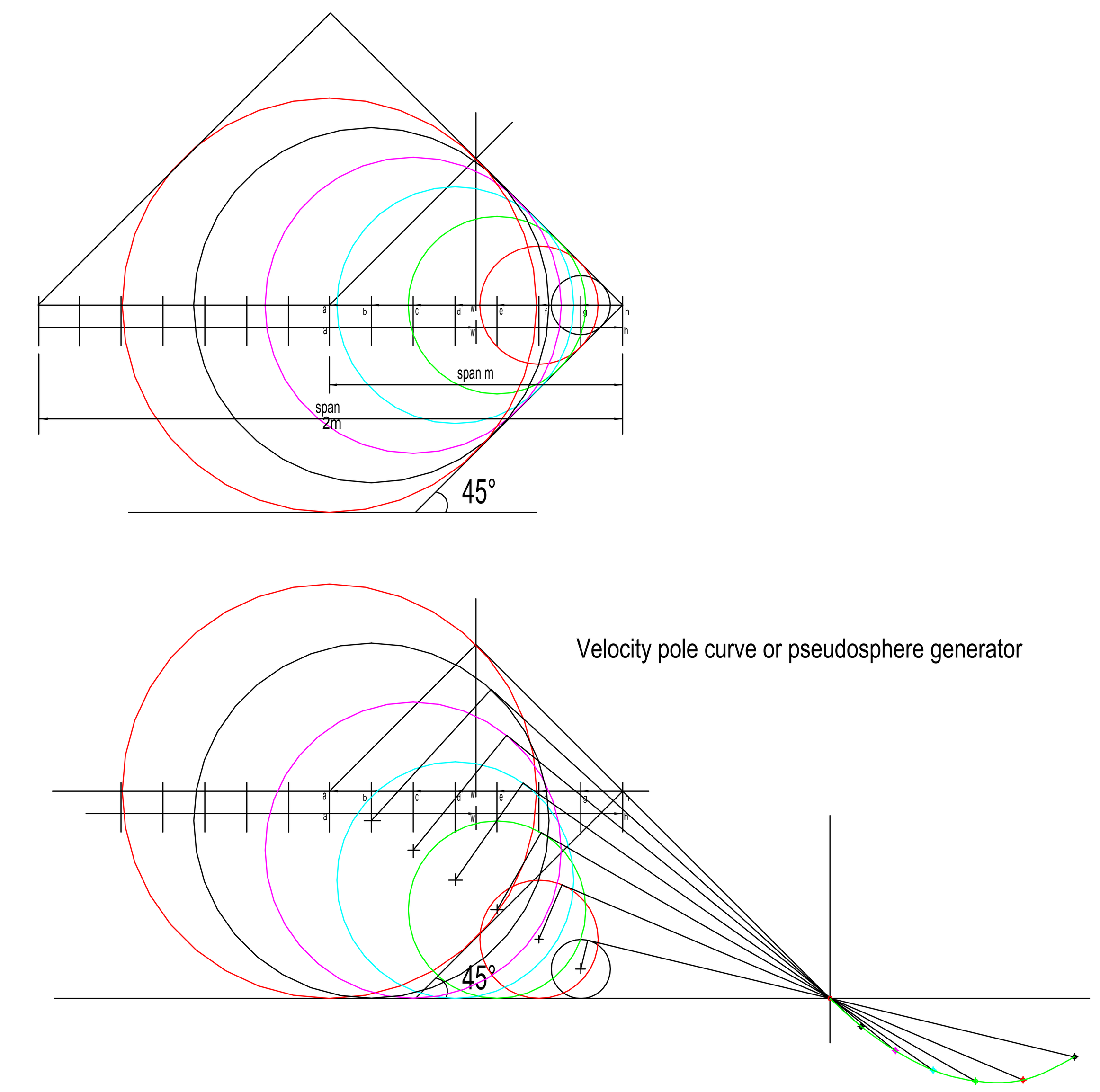
As the beam starts to bend, a spiral if you will, starts to form which separates the two psudeospheres. The height of the psudeospheres will increase with increased confinement, as with insulation around a wire.

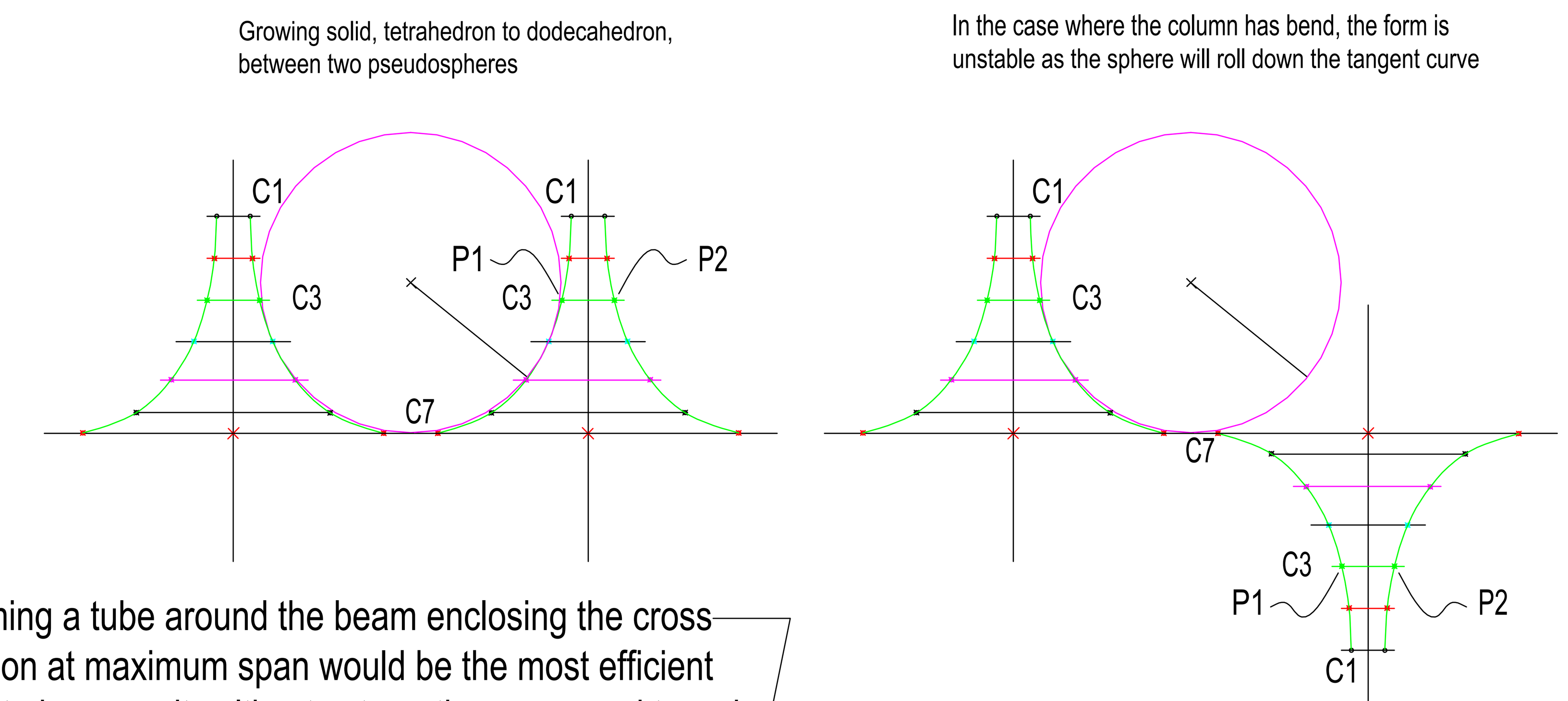
One needs to calculate the length of the tractrix in order to determine where the stress distribution in the cross section ends which will depend on the starting angle of the spiral and the number of rotations.

If the curvature of the beam is large and the surfaces have not reversed completely, one can also approximate the stress distribution by a parabola. At the ultimate, the stress distribution will be similar to a bell curve.







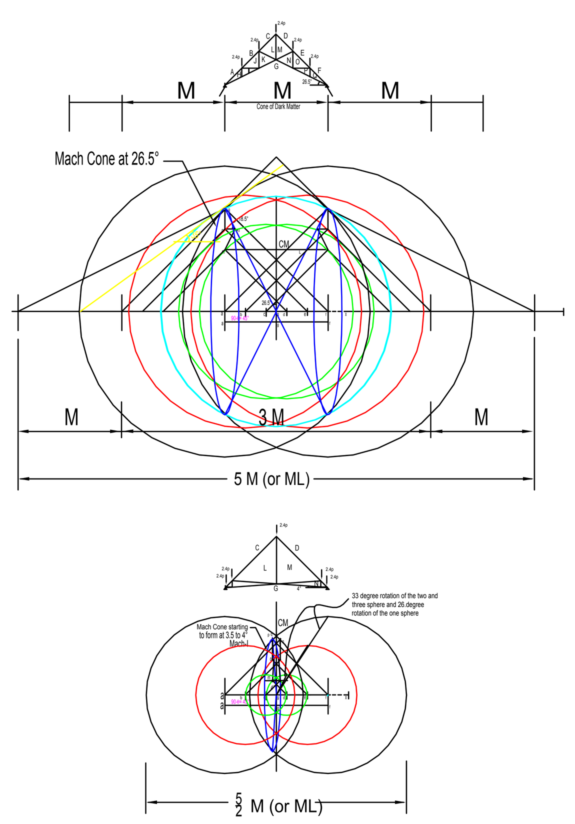


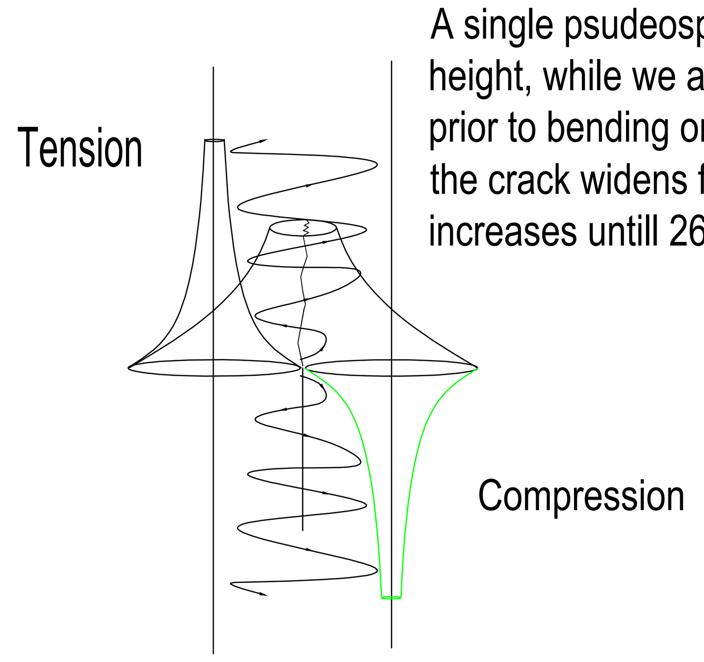
Stability considerations

At 4 degrees, Mach-1, the pseudospheres start to separate into two

Total width of crack in one cone or one pseudosphere would be 8 degrees.

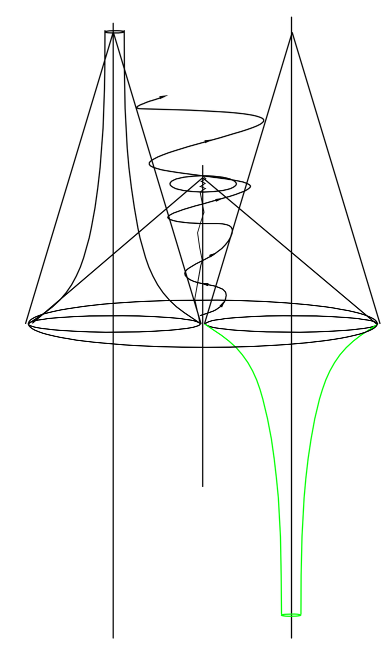
what we have as a mass of 2.5 at 4 degrees increases to 5 at 26.5 degrees.

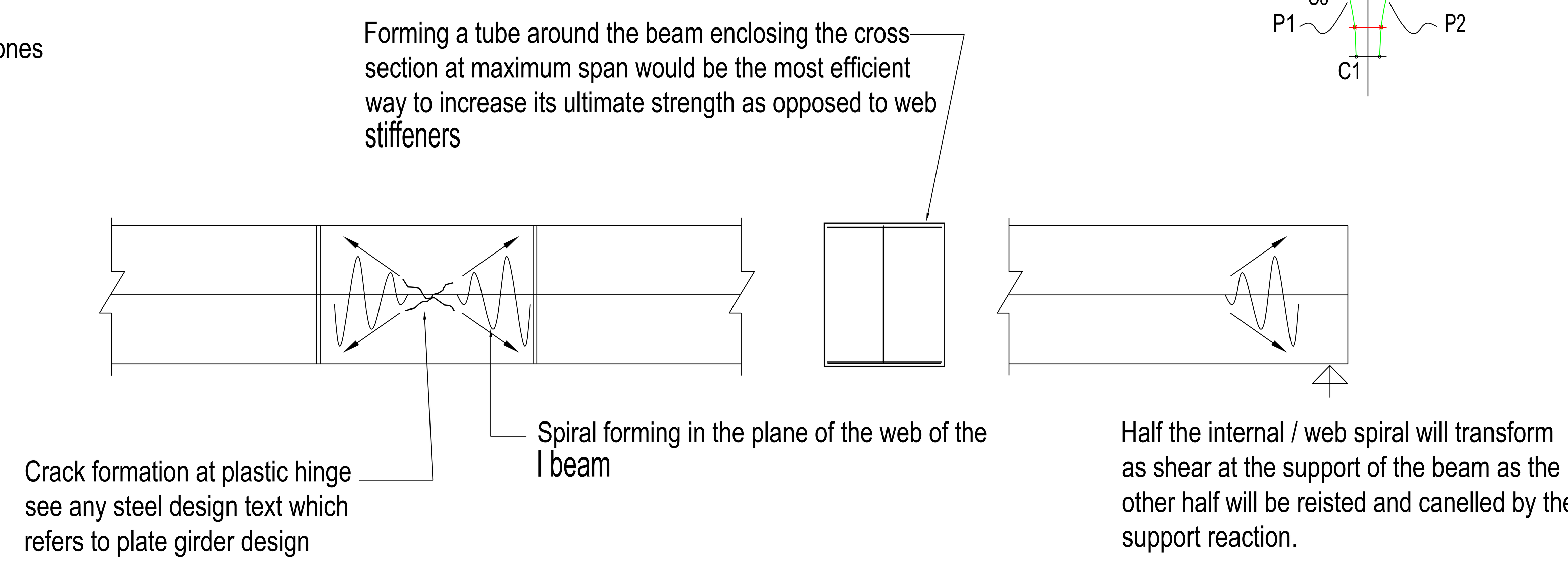




A single psudeosphere of roughly half the height, while we are still in pure compression, prior to bending or buckling, splits into two. As the crack widens from 4 degrees, the height increases untill 26.5 degrees, at Mach-5.

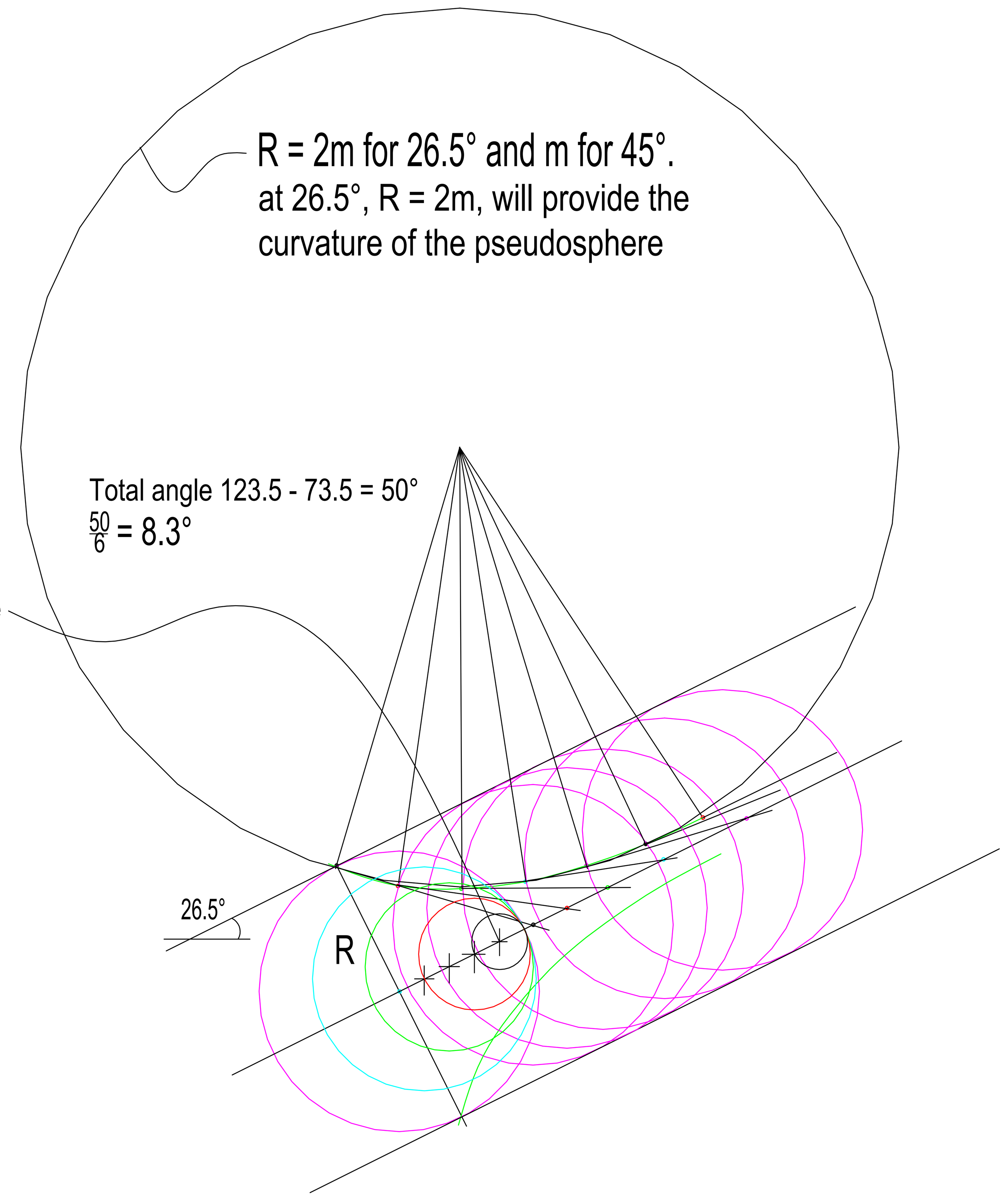
Simplify the diagram using cones

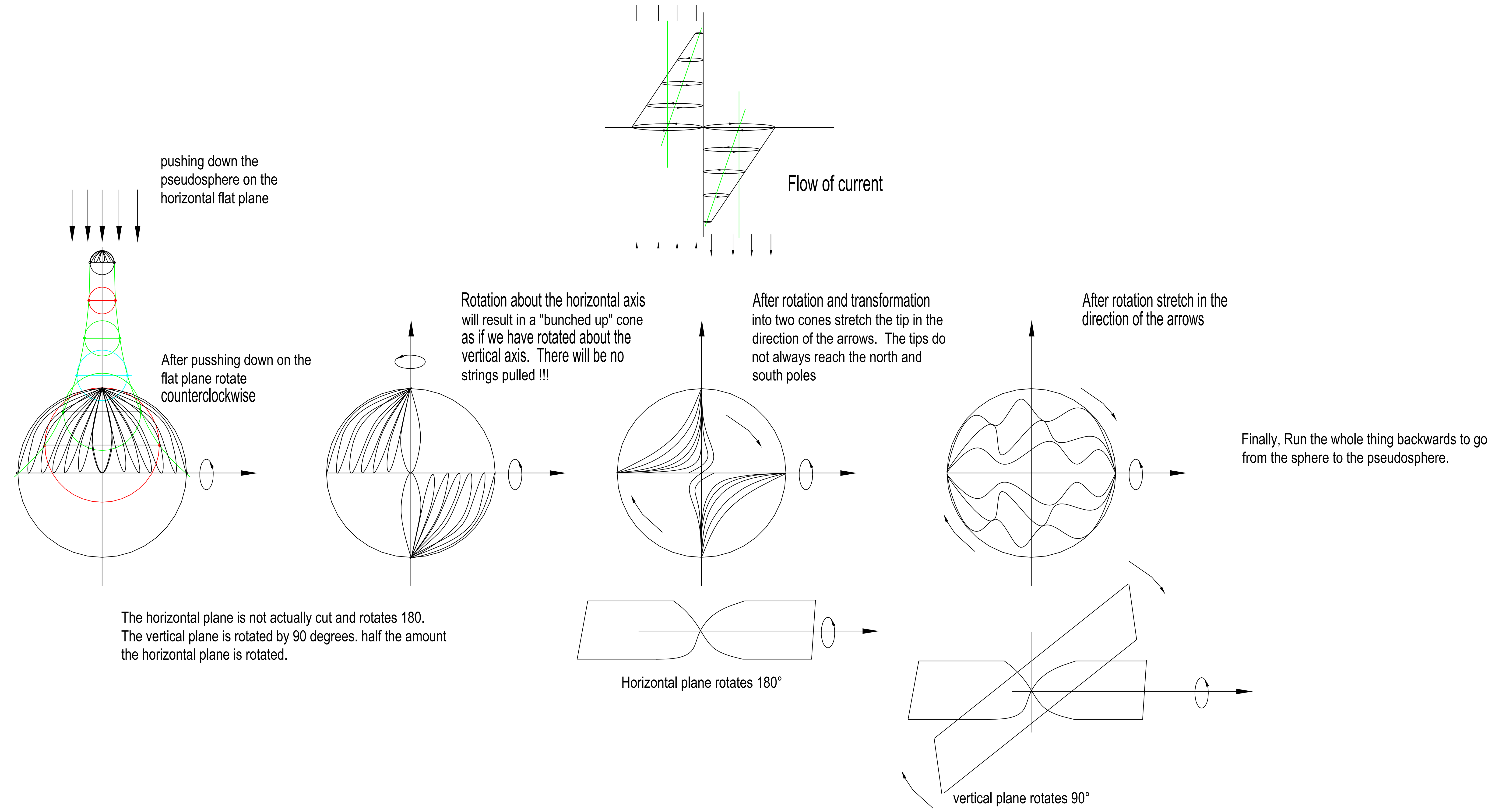




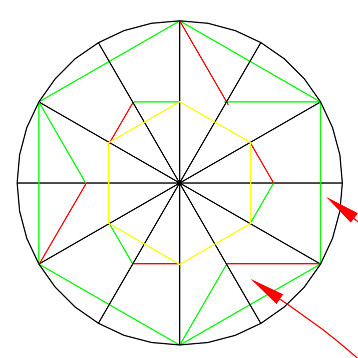
The concept of "Tube in Tube" will not be as efficient as first letting the spiral to form onto the flat plane of the beam web and then containing it with an external tube / jacket. In esssense we trick the forces and distribute them on the plane of the web and contain them at the periphery.

Let the diameter of each sphere touch the surface of the pseudosphere, then spheres are spaced equidistant at 12'-3"

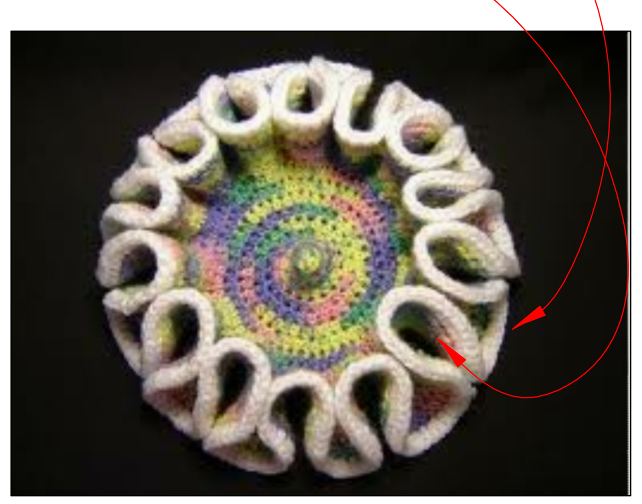




Edge of the pseudosphere as an equilateral hexagon representing the hyperbolic surface. The number of edges and length of each edge would play a major role in the shape and depth of the fault planes

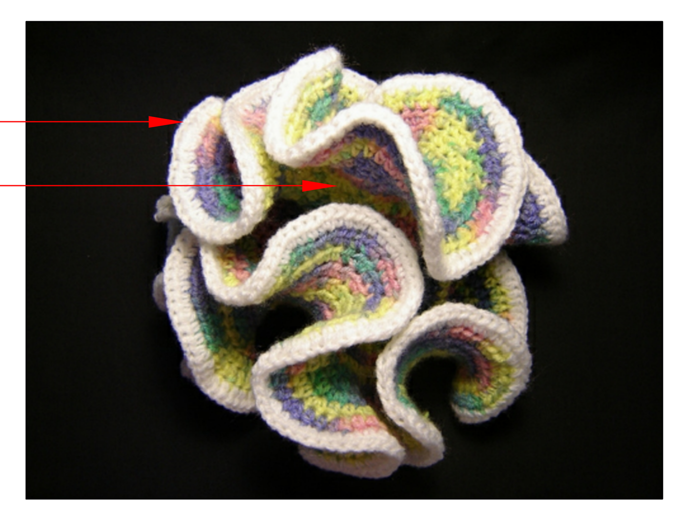


Crushing a material. Matter is assumed to have formed between the surfaces/slip planes or faults on which they can slide. The lines of the surface can also represent the path along which the elementary particles would travel



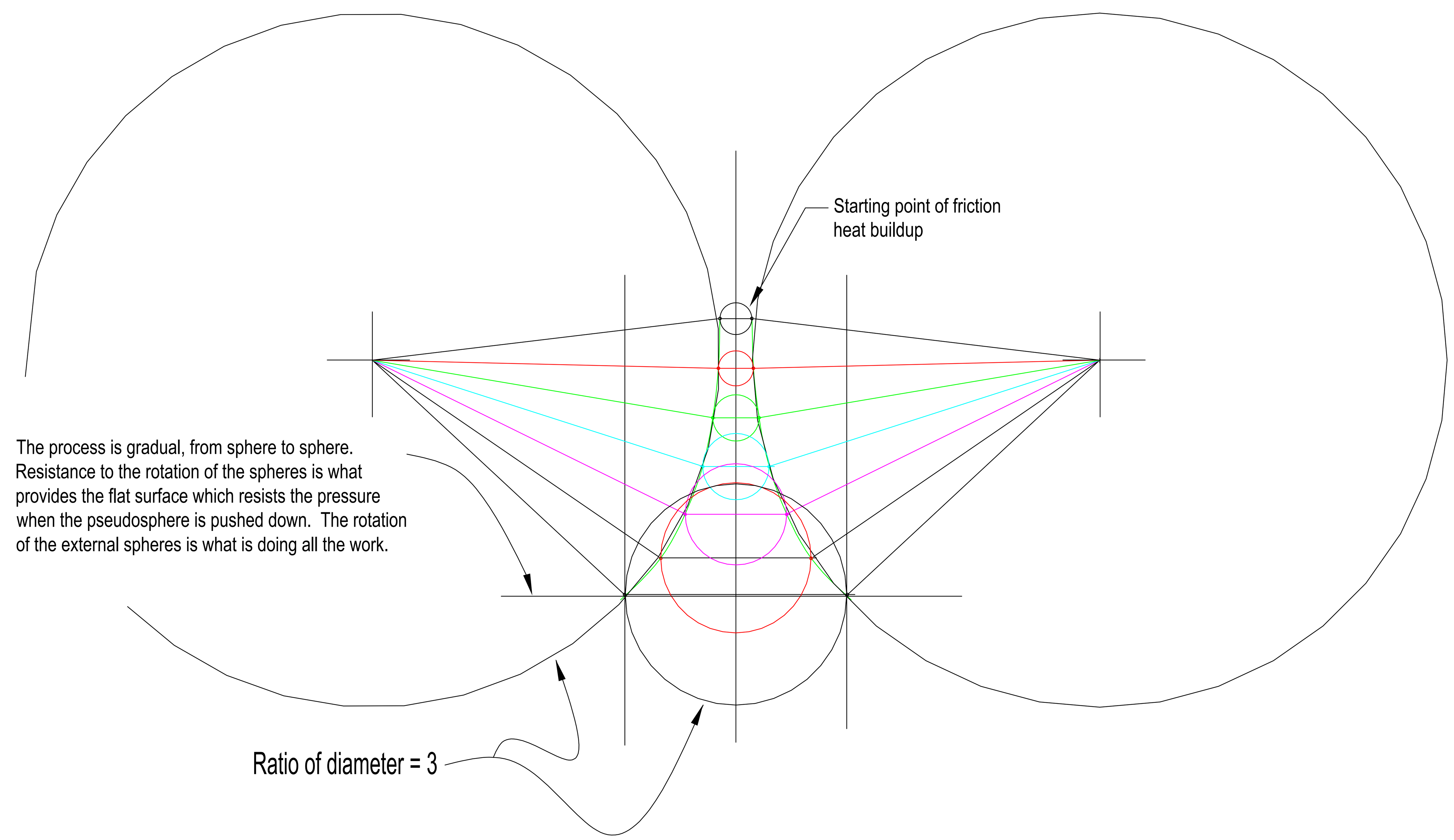
Folded surface

Matter



Push down on the pseudosphere
Hyperbolic Crochet figures obtained from google search =pseudosphere crochet

Push down on the pseudosphere, rotate and stretch - without pulling strings - only brute force. This is what the brain looks like!



As the exteior spheres rotate there is friction buildup between the spheres in the form of heat. This gradual buildup of heat will result in gradual buildup of the pseudosphere as it is "crushed" to its final form.