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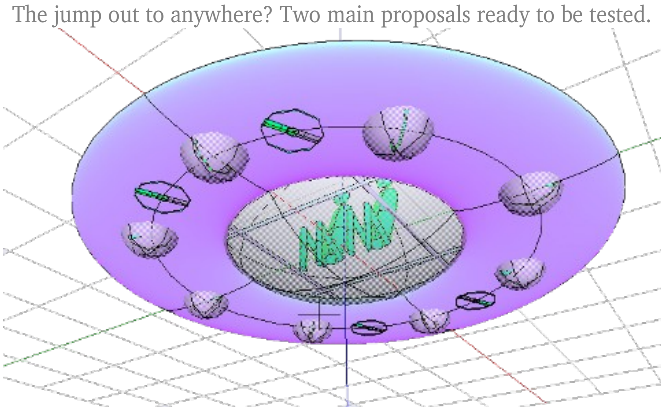
Anti-gravity

The jump out to anywhere? Two main proposals ready to be tested.



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ABSTRACT

The physico-mathematical description of two systems that may probably generate internal thrust is presented in this article. These are *System-V* and *System-VII*. We have reasons to believe such a thrust can probably be generated by means of adequately moving mass in the interior of these systems, and without any sort of expulsion of matter or energy. We will call this *internal-mass-propulsion*. If true, these concepts may lead to a new generation of propulsion engines for cars, boats, aircraft, etc., but also to the construction of *anti-gravity* devices capable of creating *levitation* effects, as those described in the mythic *flying-saucer*, for example. The physics presented herein are part of an application recently sent (October 2013) to the "*Göde-Preis für Gravitationsforschung*"[1], an award offered by the *Göde-Stiftung Institute for Gravity Research*[2], Germany, to overcome gravity.

1. The anti-gravity wonder

Anti-gravity is impossible, if we imagine that such a system would mean creating a force from within the system itself, without complying with the usual "action-reaction" present in our day by day systems. In effect, what moves something is a reaction-force, not an action-force, and this reaction-force is always applied upon the system by something external to the system: the surface of the ground impulses us forward while walking; the fluid impulses the boat or aircraft forward when by means of a propeller one forces it to move backward; the impulse of the mass leaving at high speed in a jet propulsion system, impulses the craft in the opposite direction, etc. We could even basically say that forces only exist in pairs, not alone as single vectorial entities.

In order to better understand the difficulty of achieving what we may really call "anti-gravity" we may first imagine some sort of isolated system somewhere there in the empty space, for example. It can be a person, for example. And then let us question ourselves about how that person could, initially at rest, start to move by their own means without expelling anything from the "system"? If there would be two people together it would be easy at least to generate an impulse by them pulling each other apart in opposite directions, but that would mean that the initial system of two people was meanwhile broken into two different systems of one person moving apart from the other. And that would not be a case of *internal-propulsion*. Of course the same would happen if the impulse could be achieved by facing two magnets to repel each other, for example, or two surfaces of the same charge type, etc. None of these effects can be considered as *internal-propulsion*, and none of those proposals can lead to what could effectively be called an "*anti-*

[1] Only later I have learned that this prize will not be awarded to solely theoretical descriptions, therefore since then I am searching for some technical support to construct and test those devices. I will offer 10% of the prize to those who may help me achieving it, in the case the results are positive and I will receive such a prize.
[2] http://www.goede-stiftung.org/

gravity" device, or to *levitation* in the gravitational field. An interesting exception would perhaps be those "anti-gravity" effects purportedly produced by gyroscopic systems, but it should be understood that in these cases what is being produced are torques, not linear forces. And, as we know, a torque does not change the linear state of motion of a system. The centre-of-mass remains static. Thus, all those impressive effects of "*levitation*" demonstrated to the public by Eric Laithwaite during the sixties have till now remained as simply illusions of "*anti-gravity*". Till now, that is...

We may nevertheless notice that all the proposals for "*anti-gravity*" presented up to the present day have lacked a clear physico-mathematical description that would allow a better understanding on how those devices were expected to work. These devices mainly resulted from experimental work, and their dynamics were frequently described in a mystical way, by means of certain sorts of "energies" and flows and exchanges of "powers". In this article, we try to avoid these mystical descriptions and present the theoretical derivations of the physical relations governing each of the two systems. Only based on such results could we suspect that there may be a good chance of generating *internal-mass-propulsion*. The doubts that persist at this moment are those belonging to the *grey-zone* which always lives between reality and mathematical models. Thus, wisdom tells us to experiment now, and discuss later the details. Would such results violate the 3rd law of Newton, that of "action-reaction"? Maybe not, if the impulse would result directly from it. Would it instead violate the conservation of the centre-of-mass of the universe? Well... we are not talking of natural motion, but... would space probes, for example, also eventually violate it?

2. The *System-VII*

We start by first describing *System-VII* due to the fact it is much simpler that *System-V*. And no special apparatus is needed in order to build a prototype or to test it. In effect, the reason why we could not yet test this system by our own means is somewhat ridiculous and, at the same time, curious, because it has nothing to do with science, but most probably with a country: two years after deciding to give up teaching in a university that was showing serious symptoms of corruption, something normal when we live in a corrupted system, the possibility of having access to a laboratory where such a prototype could be created and tested was rapidly diminishing. Such a laboratory must have enough resources to allow the construction of the prototype and the testing of the principle. Some people had tried to help at the beginning; they were very interested in these ideas, but, as we further explained the more important technical details, something seemed to affect them all, and they suddenly disappeared, or fell into a mysterious silence, the communications started to fade, and then these have vanished too. It was like doors closing with people staying inside of their homes. Once again, curiously, could this mean that these systems could probably work? Or did they seem ridiculous, for some reason? Or was it a cultural phenomenon related to a natural lack of communication obviously present in many other situations? Would the same have happened in Holland, Denmark, or Austria, for example? Could those people be mainly interested in understanding better these ideas with some hidden personal intentions? Present times are showing us that certain "modern" humans are acting fairly primitively. But...

System-VII is simply a rotor where an unbalanced mass is made to rotate with certain angular speeds. Figure 1 shows an experimental vehicle using two of these rotors for improved horizontal stability.

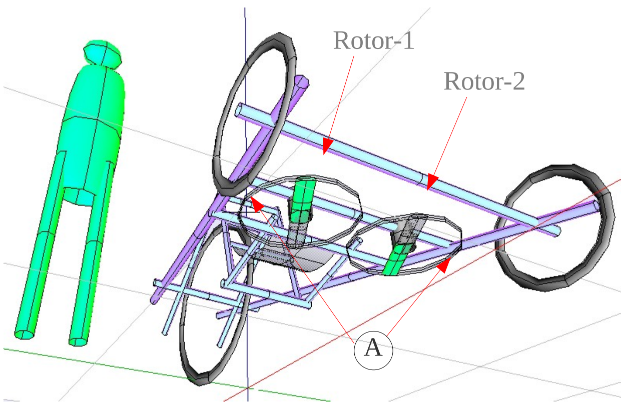

Fig. 1 *System-VII* experimental vehicle basic apparatus, with two rotors and their blades. Bottom-up perspective view.

To minimise vibrations induced in the vertical direction we propose to use a tube attached to the rotor previously compressed into the form of a blade, and then filled with more mass in one side than the other. It is expected that this will help the blade to rotate with more stability, as it plays with the density of the fluid in which it is operating, if that will be the case.

The motion of each rotor is to be controlled by a very simple electronic circuit, whose function is simply to change the rotational speed of the rotor each time one of the blades crosses point **A**. This, of course, may be done in many several ways, by using several types of sensors, but a very simple way of implementing it in a first phase for testing the principle is simply to change the speed of the rotor in each half cycle: this is very easy to achieve by means of either a *stepper-motor* or a several poles *brush-less* motor.

As we will see, there will be associated to the more massive element of the blade an angular frequency ω_1 when it travels in the half-circle-1, and an angular frequency ω_2 while it is travelling in the half-circle-2. This means that we will have a rotor permanently rotating with two different velocities. And we believe such may result in the generation of a net thrust proportional to the difference of the two frequencies, along a preferential direction. If this will happen, we will have a true *mass-propulsion-device*. The physics and mathematics related to this *System-VII* are as follows:

Let us for simplicity consider a single rotor where a mass *m* is rotating at a distance *r* from the centre (Fig. 2), and the description of motion be based on the angle of rotation θ, since *r* will naturally be a constant.

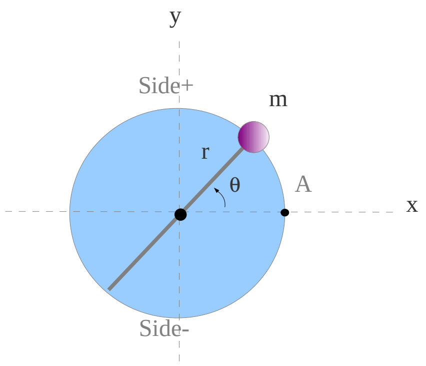

Fig. 2 Simplified model for each of the *System-VII* rotors, where point *A* represents the point where speed must change, each time any of the arms crosses it.

For the general situation, the mass will be instantaneously located at the position vector $\underline{r}(t)$, with components:

$$\underline{r}(t) = \{ x(\theta(t)), y(\theta(t)) \}$$
$$\underline{r}(t) = \{ r \, . \, \cos(\theta(t)), r \, . \, \sin(\theta(t)) \}$$
$$\underline{r}(t) = r \, . \, \{ \cos(\theta(t)), \sin(\theta(t)) \} \qquad (1)$$

Assuming the angular velocity ω as constant, its velocity vector $\underline{v}(t)$ will be:

$$\underline{v}(t) = r \, . \, \omega \, . \, \{ -\sin(\omega.t), \cos(\omega.t) \} \qquad (2)$$

While its acceleration will of course be given by:

$$\underline{a}(t) = - r \, . \, \omega^2 \, . \, \{ \cos(\omega.t), \sin(\omega.t) \} \qquad (3)$$

This is obviously a vector parallel to the position vector, therefore a radial acceleration, as we know. However, as we also know, when we integrate this vector during one period of rotation to compute the net impulse associated to each cycle, we will get a null result; both *cos()* and *sin()* functions have null integral over a period. Thus, a system with a single frequency of rotation will naturally show no net translation in any direction.

Notice that the classic attempts for "breaking" the symmetry of a circle in order to try to generate some net motion along a preferential direction all insist in the idea of "breaking" the symmetry of the spatial dimension, which is directly related to the position vector $\underline{r}(t)$, and very hard to break, at least in the plane of rotation. These attempts have led to the study of some very interesting geometric figures, like, for example, the cardioid, and several others. However, always with negative results.

But suppose now that we forget the idea of breaking the "spatial" dimension and instead focus the attention into a much easier task: to break the "velocity" dimension. This would mean that it would still be possible to produce an acceleration, while maintaining intact the "unbreakable" "spatial" dimension. These thoughts led us to the following calculations, for the case of using two different angular velocities in the present system, which we named "*system-VII*"[3]:

Let us now call ω_+ the angular velocity of the mass while travelling in *side+* and ω_- the angular velocity while in *side-*. We then have, for the (+) side of the circle:

[3] Feliz-Teixeira, "anti-gravity-systems-VI-VII", video-presentation, 7-Nov-2013: http://www.youtube.com/embed/WQ_x4M0BDYw

$$\underline{a}_{+}(t) = -r\,.\,\omega_{+}^{2}\,.\,\{\cos(\omega_{+}.t),\ \sin(\omega_{+}.t)\} \quad (4)$$

And, for the (-) side of the circle:

$$\underline{a}_{-}(t) = -r\,.\,\omega_{-}^{2}\,.\,\{\cos(\omega_{-}.t),\ \sin(\omega_{-}.t)\} \quad (5)$$

Notice that the first acceleration is acting in interval 0<θ<π, while the second acceleration acts in the interval π<θ<2π. Thus, this must be considered when computing the total impulse generated in the system per cycle and per unit of mass, as follows:

$$\underline{Ip}_{cycle} = {}_0\!\int^{\pi} \underline{a}_{+}(t).dt + {}_{\pi}\!\int^{2\pi} \underline{a}_{-}(t).dt \quad (6)$$

$$\underline{Ip}_{cycle} = -r\,.\,\omega_{+}^{2}\,.\,{}_0\!\int^{\pi}\{\cos(\omega_{+}.t),\ \sin(\omega_{+}.t)\}\,.\,dt \\ -r\,.\,\omega_{-}^{2}\,.\,{}_{\pi}\!\int^{2\pi}\{\cos(\omega_{-}.t),\ \sin(\omega_{-}.t)\}\,.\,dt$$

$$\underline{Ip}_{cycle} = -r\,.\,\omega_{+}^{2}\,.\,\{{}_0\!\int^{\pi}\cos(\omega_{+}.t),\ {}_0\!\int^{\pi}\sin(\omega_{+}.t)\}\,.\,dt \\ -r\,.\,\omega_{-}^{2}\,.\,\{{}_{\pi}\!\int^{2\pi}\cos(\omega_{-}.t),\ {}_{\pi}\!\int^{2\pi}\sin(\omega_{-}.t)\}\,.\,dt$$

Since both ${}_0\!\int^{\pi}\cos$ and ${}_{\pi}\!\int^{2\pi}\cos$ are null we can expect the *xx* component of $\underline{Ip}_{cycle}$ to be null:

$$\underline{Ip}_{cycle} = -r\,.\,\omega_{+}^{2}\,.\,\{0,\ {}_0\!\int^{\pi}\sin(\omega_{+}.t).dt\} \\ -r\,.\,\omega_{-}^{2}\,.\,\{0,\ {}_{\pi}\!\int^{2\pi}\sin(\omega_{-}.t).dt\} \quad (7)$$

As in general $\omega = d\theta/dt$, and as we consider ω to be constant, we may substitute dt by $d\theta/\omega$ and integrate these equations in the variable θ, which leads to:

$$\underline{Ip}_{cycle} = -r\,.\,\omega_{+}^{2}\,.\,\{0,\ [-\cos(\theta)]_0^{\pi}\,.\,1/\omega_{+}\} \\ -r\,.\,\omega_{-}^{2}\,.\,\{0,\ [-\cos(\theta)]_{\pi}^{2\pi}\,.\,1/\omega_{-}\} \quad (8)$$

$$\underline{Ip}_{cycle} = -r\,.\,\omega_{+}^{2}\,.\,\{0,\ 2/\omega_{+}\} - r\,.\,\omega_{-}^{2}\,.\,\{0,\ -2/\omega_{-}\}$$
$$\underline{Ip}_{cycle} = -2\,.\,r\,.\,\{0,\ \omega_{+}\} + 2\,.\,r\,.\,\{0,\ \omega_{-}\} \quad (9)$$
$$\underline{Ip}_{cycle} = -2\,.\,r\,.\,\{0,\ \omega_{+} - \omega_{-}\}$$
$$\underline{Ip}_{cycle} = -2\,.\,r\,.\,\{0,\ \Delta\omega\} \quad (10)$$

This last equation obviously tells us that the mass will be acted upon by a net impulse into (-) direction proportional to the difference of the two angular velocities ($\Delta\omega$). And this will probably force the vehicle to move into the (+) direction, as a natural reaction. It is also important to notice that the amount of energy needed for such a motion will obviously be supplied by the motor, it does not come from nothing. There will always exist conservation of energy, and the device is expected to accelerate only if its rotors are able to concede the required amount of energy.

But... Could this be the complete description of what in reality happens in this system? The results are very interesting and pointing in the direction of *internal-mass-propulsion*, but... can we completely trust in these computations? We are not absolutely sure, and an experimental test would better tell us if such results are right or wrong. But if we analyse with more attention the process of computing the impulse per cycle ($\underline{Ip}_{cycle}$) we may realise we have started by the equation of *acceleration*, not by the equation of *velocity*. Therefore, we were eventually missing the sudden changes of *velocity* at points **A** and **A'**, as represented in the next figure (Fig-3).

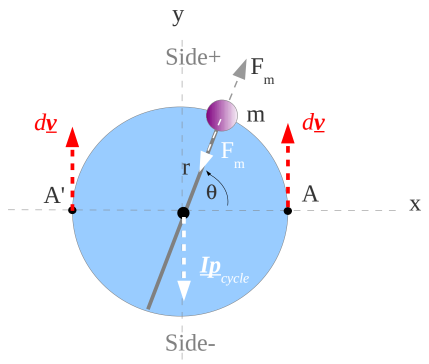

Fig. 3 More detailed model of a *System-VII* rotor, including *velocity* vector changes ($d\underline{v}$) at the points of commutation.

We therefore must add these two contributions, that is, we must add the vector $2.d\underline{v}$ to the vector $\underline{Ip}_{cycle}$ in order to get the final impulse per cycle and per unit of mass.

$$\underline{I}_{final} = \underline{Ip}_{cycle} + 2.d\underline{v} \quad (11)$$

Notice now that $dv = v_{+} - v_{-} = r.\omega_{+} - r.\omega_{-} = r.\Delta\omega$
Thus, we may write, for the *yy* direction:

$$I_{final} = Ip_{cycle} + 2.dv$$
$$I_{final} = -2\,.\,r\,.\,\Delta\omega + 2\,.\,r\,.\,\Delta\omega \quad (12)$$
$$I_{final} = 0$$

No net impulse!, since those vectores seem to cancel each other. But... once again let us question: is this what happens in reality? It seems obvious that the differences of velocities (dv) have the correct sign; but, what about the term that respects to Ip_{cycle}, is it really a (-) sign or should it instead be a (+) sign? And this simple question leads us, once again, to the eternal discussion about if *the force acting upon a rotating mass is a centripetal force or a centrifugal force*? "Newtonians", if we can use this term, defend that such a force is *centripetal*; while "Huygenians" believe that such a force is *centrifugal*. Notice, however, that in terms of the *net force* acting upon the overall system, including the *mass* and the *axis of rotation*, both cases lead to the same results. And, if the overall system is maintained static, *action* and *reaction* cancel each other. We have computed Ip_{cycle} based on the first idea, that is, considering that the force acting upon the mass (F_m) is *centripetal*, and the force acting upon the axis (F_o) is *centrifugal*. Next figure shows a diagram which helps explaining the differences between these two perspectives: case 1) represents "Newton" position, while in case 2) is depicted "Huygens" intuition.

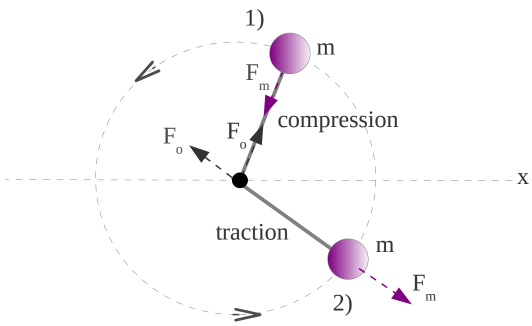

Fig. 4 Forces acting upon a mass and the axis of rotation. Will the arm be in a situation of *compression* or of *traction*?

Now, let us re-write equation (12):

$$I_{final} = - 2 \cdot r \cdot \Delta\omega + 2 \cdot r \cdot \Delta\omega$$

And notice that the (-) sign of Ip_{cycle} results from assuming case 1) as representing reality. But, if in reality the system would behave like in case 2), then this sign would be (+), instead of negative. And such a small difference would lead to a net impulse per cycle and mass given by:

$$I_{final} = 4 \cdot r \cdot \Delta\omega \quad (13)$$

Again we would have achieved a way for even creating *levitation*, suspension, fluctuation in the gravitational field. So, is there any way of knowing which of the two visions is more representative of the reality? We think so: it is enough to know if, while rotating, the arm of the rotor which connects to the mass is in a *compression* state or in a *traction* state, as figure 4 suggests. Once again, all doubts would automatically be resolved by means of a very simple and practical experiment, which for now life seems to be obstructing to be done. Nevertheless, it is now easier to believe that either we will be in presence of an *internal-mass-propulsion* system, or the following theorem will be true:

THEOREM: If f(x) is a periodic function of period T, and its derivative g(x) = (d/dx)f(x) is continuous, then it must hold: $\int_x^{x+T} g(x) \cdot dx = 0$

And such a theorem would imply that it would be impossible to generate a net impulse from a mass running around any closed path.

So, what to expect? We incite the reader to construct and test such a device, and then to contact us for discussing it. As we have noticed before, a very good economical compensation may be waiting for him/her in the case of a positive achievement.

3. The *System-V*

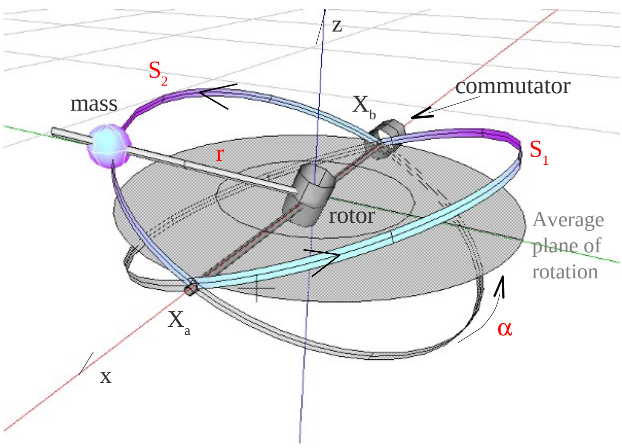

Fig. 5 The two different states (S_1, S_2) of a rotor in *System-V*. These states define two *angular-momentum* vectors. Notice that the mass is to be maintained (in the case shown) always above the *average-plane-of-rotation* by the action of the *commutator*.

Contrary to the previous system, where the net impulse is *expected* to be generated in the plane of rotation, *System-V* maintains a steady flow of mass on this plane; and, by means of a certain change in the rotor's inclination, it is *expected* to generate an impulse along the perpendicular to such a plane. That is, in the same direction of the total *angular-momentum* vector. In this case we may therefore say that the spatial symmetry of the circle of rotation is maintained, while what is generated is a *non-null* density of mass out of the average plane of rotation. Previous figure 5 helps understand what we mean.

Notice that the *average-plane-of-rotation* is the plane in the middle of the two "planar" states S_1 and S_2. It would correspond to the *horizontal-plane* in the case of a device trying to overcome gravity, for example. And it makes an angle α with each of those planes of rotation. Thus, the *commutator* must ensure a fast change of a $2.\alpha$ angle in each commutation. This, of course will require a considerable amount of energy, at least the energy needed to move the rotating mass from one plane to the other. But, looking with attention to the system, we notice that at any points belonging to the line of interception of the two planes S_1 and S_2 this energy is minimal, or can even be almost zero. Such a line is the *xx* axis in figure 5; and these two points are of course X_a and X_b. Let us now try to understand what happens in each commutation (Fig.6):

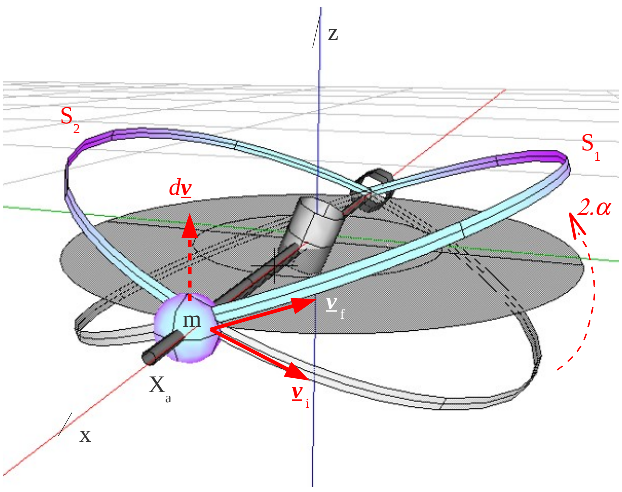

Fig. 6 The commutation between states (S_1, S_2) is made at the points X_a and X_b where the plane of rotation crosses the *xx* axis. The change in the velocity vector ($d\underline{v} = \underline{v}_f - \underline{v}_i$) due to a *commutation* is shown for the case when the mass is passing through X_a. The *angle of commutation* is $2.\alpha$.

At each point of commutation the mass is made to change from one state to the other; which means changing from an *angular-momentum* vector to another *angular-momentum* vector. In principle, as we know, such a change should result from an external torque acting upon the system. But... could this particular case be something different? What is the energy (or torque) needed to rotate a mass around an axis when the mass is at a position which belongs to such an axis? If we may look at the "dynamics" as a sequence of static moments, then we should expect that this energy would be null for a point-mass. And, in the case of a mass with certain dimensions, be only dependent on the *moment-of-inertia* of that mass in respect to such an axis. And this can be made minimal, by design. So, we may also wonder: what will be the behaviour of a system which state of motion has been changed with practically no energy consumption? That is the magical point of this discussion. What will then happen in the system?

Well... what we can do is to follow the rules of our models of mechanics, and try to analyse how the velocity vector of the rotating mass changes at each commutation. As shown in figure 6, this tells us that an impulse ($d\underline{v}$) is being generated at those strategic points; and both impulses (at X_a and X_b) happen to be in the same direction. Besides, they do not seem to be generated by torques; they very much seem to be linear impulses acting upon the mass m. If we consider that each of these impulses is acting only during a very small time interval δt, then we may expect them to be related to a force given by:

$$\underline{F}_m = m \,.\, d\underline{v} / \delta t \qquad (14)$$

Such a force, however, will act upon the rest of the structure of the system too, which from now on is considered to have mass M. Therefore, a device or craft with mass M being "impulsed" by a *System-V* cell of mass m will be subject to an acceleration given by:

$$\underline{a}_{M+m} = \underline{F}_m / (M+m) = \{m/(M+m)\} \,.\, d\underline{v} / \delta t \qquad (15)$$

And, if we suppose M and m being related by a multiplicative factor β, with $M = \beta \,.\, m$, we can even write this relation independent on the masses:

$$\underline{a}_{M+m} = \{1/(\beta+1)\} \,.\, d\underline{v} / \delta t \qquad (16)$$

Will these impulses of acceleration have enough magic to lead us out of gravity ($\underline{g}$)? In effect, we may expect the overall structure to fluctuate when the two *impulses-per-cycle* generated by means of $\underline{\boldsymbol{a}}_{M+m}$ will compensate the impulse due to gravity in the same time interval (T). That is, the craft will fluctuate when:

$$2 \,.\, \underline{\boldsymbol{a}}_{M+m} \,.\, \delta t = -\boldsymbol{g} \,.\, T \qquad (17)$$

where of course $T = 2.\pi / \omega$ is the period of the rotation, and ω is the angular speed.

Let us now try to express $d\underline{v}/\delta t$ in terms of the characteristic parameters of our system: which is basically a rotor of radius r rotating with an angular speed ω, for now considered constant. Through figure 6 and knowing that $v = r.\omega$ we can see that:

$$\underline{v}_i = r \,.\, \omega \,.\, \{0, \cos(\alpha), -\sin(\alpha)\} \qquad (18)$$

$$\underline{v}_f = r \,.\, \omega \,.\, \{0, \cos(\alpha), +\sin(\alpha)\} \qquad (19)$$

Therefore we have:

$$d\underline{v} = \underline{v}_f - \underline{v}_i = r \,.\, \omega \,.\, \{0, 0, 2.\sin(\alpha)\} \qquad (20)$$

Since the effect in principle belongs solely to the zz axis, we may simply write:

$$dv = 2 \,.\, r \,.\, \omega \,.\, \sin(\alpha) \qquad (21)$$

Therefore the modulus of $d\underline{v}/\delta t$ will be:

$$dv/\delta t = 2 \,.\, r \,.\, \omega \,.\, \sin(\alpha)/\delta t$$

Finally, if we express δt as a fraction of the period of rotation, that is $\delta t = \eta.T$, and use $T = 2.\pi/\omega$, then, substituting δt in the last equation leads us to:

$$d\underline{v}/\delta t = [\, r.\, \omega^2 \,.\, \sin(\alpha) \,/\, (\eta.\pi)] \,.\, \underline{\hat{\boldsymbol{u}}}_z \qquad (22)$$

The *acceleration-per-impulse*, taken from equation (16), becomes:

$$\underline{\boldsymbol{a}}_{M+m} = \{1/(\beta+1)\}.[\, r.\omega^2.\sin(\alpha) \,/\, (\eta.\pi)].\underline{\hat{\boldsymbol{u}}}_z \qquad (23)$$

Remembering again that $\delta t = \eta.T$, the condition for the craft to fluctuate, from equation (17), can now be written as:

$$2 \,.\, \underline{\boldsymbol{a}}_{M+m} \,.\, \eta \,.\, T = -\boldsymbol{g} \,.\, T$$

$$\underline{\boldsymbol{a}}_{M+m} \,.\, \eta = -\boldsymbol{g}/2$$

Leading to:

$$r.\omega^2.\sin(\alpha)/[\pi.(\beta+1)] = g/2 \qquad (24)$$

$$\omega^2 = (g/2).\pi.(\beta+1)/[r.\sin(\alpha)] \qquad (25)$$

Therefore leading also to the following minimal frequency of rotation for achieving *levitation*:

$$\boldsymbol{\omega}^+ = \{g.\pi.(\beta+1)/[2.r.\sin(\alpha)]\}^{1/2} \qquad (26)$$

A curious result is the fact that this expression[4] seems not to be dependent on η.

Example: To finally end this text, let us try to estimate the value of $\boldsymbol{\omega}^+$ for a practical case of a craft of mass (M) ten times bigger that the mass (m) of a *System-V* cell, that means $\beta = 10$; and let us use a single *System-V* cell of 1 metre radius ($r = 1$) operating in a very small angle of 2 degrees ($\alpha = 2$), and with a time of commutation being 1/10 of the period of rotation ($\eta = 0{,}1$). The calculation will lead to:

$$\boldsymbol{\omega}^+ = 70 \text{ rad/s} = 11{,}2 \text{ Hz} = 670 \text{ rpm} \qquad (27)$$

Which is a perfectly achievable frequency. A previous computation based on a slightly different approach was also leading us to the frequency:

$$\boldsymbol{\omega}^+_{prev} = 266 \text{ rad/s} = 42{,}4 \text{ Hz} = 2540 \text{ rpm} \qquad (28)$$

Well, a prototype will let us definitely know what happens when a *System-V* is made to rotate at such frequencies. Please contact if you are interested in allowing such to happen.

Author's Biography:

J. Manuel Feliz-Teixeira, graduated in Physics, Masters in Mechanical Engineering and Doctorate in Sciences of Engineering from the University of Porto. He has been dedicated to various fields of knowledge and several industrial projects. More recently, he became mainly interested in lecturing Physics and studying *electromagnetism and gravitation* by means of classical principles.

[4] A previous computation based on a slightly different method have lead us to the result: $\boldsymbol{\omega}^+ = \{g.\pi^2.(\beta+1)/[4.\eta.r.\sin(\alpha)]\}^{1/2}$