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SUBJECT

"MOTION OF A MATERIAL POINT WITH RESPECT TO A NON-INERTIAL FRAME SYSTEM."

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INTRODUCTION.

On 6th May 1993, the author of the present work presented a thesis with the title "Preferential frame systems" in a lecture at the University of Ioannina. He claimed to have proved the theoretic rejection of the Theory of Relativity. The critical point was a theoretic experiment (an observer makes circles in an aeroplane over an observer who fires a gun horizontally in a vacuum contained in a pipe).

He argued that the two observers in their description of the motion of the bullet which was fired are not subject to the same laws of physics, and therefore the Theory of Relativity is not valid (it follows that the velocity of light is not the same for the two observers).

As for the above thesis, the Union of Greek Physicists wrote that it was a pioneer work and was being examined by University professors, although, apparently, the author was a taxman.

However at the lecture at the university of Ioannina, Professor Raptis asked the writer two questions: a) Mr. Charalambopoulos, the bullet will describe a curve due to gravity, so what would happen in that case? and b) Can you give us the transformations which describe the motion of the bullet from the non-inertial frame system?

The first question was answered as follows: "on the horizontal axis of the coordinates by which we analyse the motion of the bullet, the law of momentum and angular momentum preservation is in effect for the stationary observer (but not for the non-inertial) and in the same way the law of the preservation of energy is in effect for the orbit of the bullet." Indeed the then Professor (now Dean) Massalas, who had organized the lecture, mentioned that "we can achieve linear motion with great accuracy when we give constant velocity in a vacuum to a charged particle which moves in a suitable adjusted electric and vertical magnetic field."

The second question (which are the transformations for the non-inertial observer) was only partially answered. Can classical physics even answer this? This will be examined in this thesis.

There was also, you see, the experiment conducted by the writer which, obviously because of faulty experimental measurements, "proved" that centrifugal force was a real force.

Nature was unanswerable after the decisive experiment of great accuracy and with the use of trustworthy equipment which was conducted by professor Pericles Tsekeris at the School of Natural Sources of Agrinion (branch of the University of Ioannina).

The centripetal force alone was enough to describe the phenomenon, since it was equal to the traction force of a spring stretched by a revolving mass. The centrifugal force was now exposed as a hypothetical force which, together with the related Coriolis force, threatened the refutation supported by the writer at the University of Ioannina (of the Theory of Relativity).

FORCES ASSUMED BY NON-INERTIAL OBSERVERS, ACCORDING TO CLASSICAL PHYSICS.

As is known, a non-inertial observer is the observer who is involved in the motion of a frame system which is under acceleration.

In the case where the motion is curved, inertial observer who examines the motion accepts that the traction force towards the centre of the curve is equal to the centripetal force as follows:

$$\boldsymbol{F}_{\text{traction}} = \frac{G M_1 M_2}{r^2} \quad \text{or} \quad \frac{k q_1 q_2}{r^2} = M_2 \omega^2 r = \frac{M_2 \upsilon^2}{r}$$

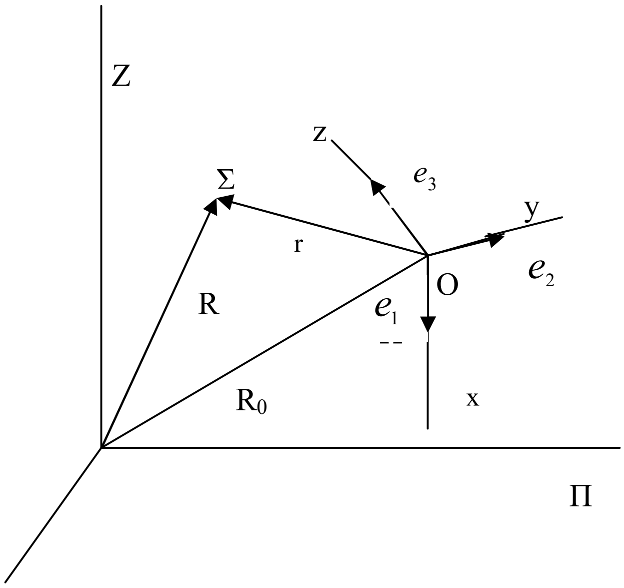
where the traction force can be gravity, or the electric traction force Coulomb, or the tension on a thread holding a revolving mass etc and r is the curve radius.

As is in effect for classical physics, the non-inertial observer who takes part in the curve motion supposes that he is subject to centrifugal force in the opposite direction with the centripetal to be able to explain the phenomena, and also assumes a Coriolis force to explain the motion of some other body[1] he observes, which forces are called upon as hypothetical forces of inertia.

[1] "Physics", by Halliday-Resnick, part A, page 120. "Mechanics" of the University of Berkeley, page 90. "Theoretic Mechanics", by Ioannis Chatzedemetriou, part 1 page 218. "Mechanics", by Elias Kouzioumtzopoulos, page 171.

MOTION IN AN INERTIAL SYSTEM ACCORDING TO CLASSICAL PHYSICS.

(The theory and the charts are taken from "Mechanics", by the former Professor of the University of Thessalonica J. Chatzedemetriou, who the writer had the honour of meeting in 1986 and hearing his kind encouragement.)



Plan. 1

We consider the immovable (inertial) frame system Ωξπζ with the axis centre at Ω (above chart). We also consider another frame system Oxyz which is in motion in relation to the first system ($\mathbf{e}_1$, $\mathbf{e}_2$ and $\mathbf{e}_3$ are its vector units).

Finally we have a material point Σ moving in space. If the moving frame system Oxyz is non-inertial, we shall try to find the equations of the motion of point

from this system.

Thus we consider that the non-inertial frame system is performing a motion in relationship with the inert whose axes are parallel (in relationship to the inert) and a circular motion around its centre (the non-inertial motion is analysed in both these motions).

In the small time $\Delta t<I$, the following is in effect:

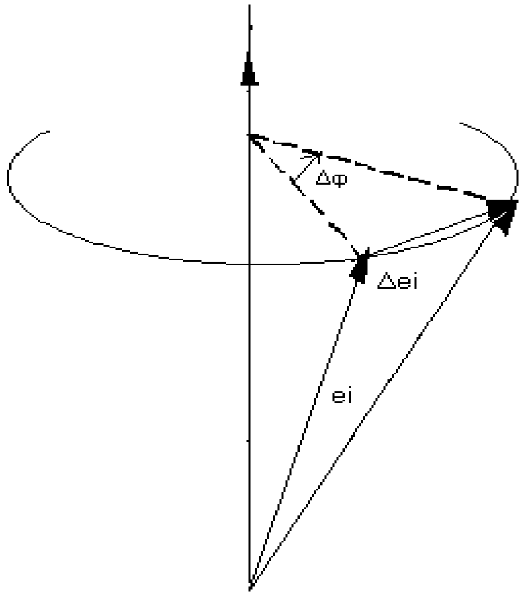
$\Delta\boldsymbol{\varphi} = \Delta\varphi\boldsymbol{\kappa}$ where $\Delta\varphi$ is the angle of rotation of the non-inertial system around the centre O.

The rotation of the system Oxyz around the centre O is shown in the following chart.

The following is in effect: $\Delta\mathbf{e}_1 = \Delta\varphi \, x\mathbf{e}_1 \Rightarrow \dot{\boldsymbol{e}}_1 = \boldsymbol{\omega} x \boldsymbol{e}_1$ **(1)**

Where ω is the angular velocity and the following is in effect: $\boldsymbol{\omega} = \lim_{\Delta t \to 0} \cdot \frac{\Delta\varphi}{\Delta t}$

In general the following is holds: $\dot{\boldsymbol{e}}_i = \boldsymbol{\omega} \, x \, \boldsymbol{e}_i$ **(2)**



Plan. 2

We consider a vector of position A which changes with time, and it is obvious that the change is different in the two frame systems. Thus the following is in force:

$\mathbf{A} = A_\xi\, \boldsymbol{\varepsilon}_1 + A_\pi \boldsymbol{\varepsilon}_2 + A_\zeta \boldsymbol{\varepsilon}_3$ **(4)** where $\boldsymbol{\varepsilon}_i$ are the vectoral units of the stationary system Ωξπζ. Also:

$\mathbf{A} = A_\chi\, \mathbf{e}_1 + A_y \mathbf{e}_2 + A_z \mathbf{e}_3$ **(5)** in the moving Oxyz.

The measurements of **A** on the three axes are functions of time since it changes and:

Absolute derivative	$\frac{d_\alpha \boldsymbol{A}}{dt} = \dot{A}_\xi\, \boldsymbol{\varepsilon}_1 + \dot{A}_\pi\, \boldsymbol{\varepsilon}_2 + \dot{A}_\zeta\, \boldsymbol{\varepsilon}_3$	**(6)**
Relative derivative	$\frac{d_\sigma \boldsymbol{A}}{dt} = \dot{A}_x\, \boldsymbol{e}_1 + \dot{A}_y\, \boldsymbol{e}_2 + \dot{A}_z\, \boldsymbol{e}_3$	**(7)**

As can be understood, $\frac{d_\alpha \mathbf{A}}{dt}$ is t he change in the position vector, which is understood by the observer in the stationary system, and $\frac{d_\sigma \mathbf{A}}{dt}$ in the non-inertial.

So that we may find the relationship which exists between $\frac{d_\alpha \mathbf{A}}{dt}$ and $\frac{d_\sigma \mathbf{A}}{dt}$, we enact the following (since the $\mathbf{e_i}$ in the non-inertial system also change) in the equation, based on (4) = (5):

$$\frac{d_\alpha \boldsymbol{A}}{dt} = (\dot{A}_x \boldsymbol{e}_1 + \dot{A}_y \boldsymbol{e}_2 + \dot{A}_z \boldsymbol{e}_3) + (A_x \dot{\boldsymbol{e}}_1 + A_y \dot{\boldsymbol{e}}_2 + A_z \dot{\boldsymbol{e}}_3) \qquad \textbf{(8)}$$

and according to (2) and (7)

$$\frac{d_\alpha \boldsymbol{A}}{dt} = \frac{d_\sigma \boldsymbol{A}}{dt} + \boldsymbol{\omega} x \mathbf{A} \qquad \textbf{(9)}$$

We now consider that the position vector of the moving material point Σ in the unmoving system is: $\mathbf{R} = \mathbf{\Omega\Sigma}$ and $\mathbf{r}$ the position vector in the non-inertial system $\mathbf{r} = \mathbf{O\Sigma}$.

In the inert system absolute velocity is in effect:

$$\boldsymbol{\upsilon}_\alpha = \frac{d_\alpha \mathbf{R}}{dt}$$

In the non-inertial:

$$\boldsymbol{\upsilon}_\sigma = \frac{d_\sigma \mathbf{r}}{dt}$$

We observe $\mathbf{r} = \mathbf{R} - \mathbf{R}_0$ where $\mathbf{R}_0$ is the position vector of O with respect to Ω.

According to (9) we have:

$$\frac{d_\alpha \mathbf{R}}{dt} - \frac{d_\alpha \mathbf{R}_0}{dt} = \frac{d_\sigma \mathbf{r}}{dt} + \boldsymbol{\omega} x \mathbf{r} \qquad \textbf{(10)} \text{ and so}$$

$\boldsymbol{\upsilon}_\alpha = \boldsymbol{\upsilon}_0 + \boldsymbol{\omega} x \mathbf{r} + \boldsymbol{\upsilon}_\sigma$ **(11)** where $\boldsymbol{\upsilon}_\alpha$ is the absolute velocity of point Σ in the stationary system of Σ, $\boldsymbol{\upsilon}_0$ the velocity of point O moving in relation to the stationary system Ωξπζ, $\boldsymbol{\upsilon}_\sigma$ the relative velocity of the moving point Σ with respect to Oxyz and **ω** the vector of the angular velocity of rotation of Oxyz.

Thus now the acceleration is:

$$\boldsymbol{\gamma}_\alpha = \frac{d_\alpha \boldsymbol{\upsilon}_\alpha}{dt} = \frac{d^2 \mathbf{R}}{dt} \qquad \text{in the inertial}$$

$$\boldsymbol{\gamma}_\sigma = \frac{d_\sigma \boldsymbol{\upsilon}_\sigma}{dt} \qquad \text{in the non-inertial.}$$

Applying calculus in (11)

$$\frac{d_\alpha \mathbf{\upsilon}_\alpha}{dt} = \frac{d_\alpha \mathbf{\upsilon}_0}{dt} + \frac{d_\alpha \mathbf{\upsilon}_\sigma}{dt} + \boldsymbol{\omega} x \frac{d_\alpha \mathbf{r}}{dt} + \dot{\boldsymbol{\omega}} x \mathbf{r} \qquad \textbf{(12)}$$

(9) and (12) according to the above give:

$$\boldsymbol{\gamma}_\alpha = \boldsymbol{\gamma}_0 + \boldsymbol{\omega} x(\boldsymbol{\omega} x \mathbf{r}) + \dot{\boldsymbol{\omega}} x \mathbf{r} + \mathbf{2}\boldsymbol{\omega} x \mathbf{\upsilon}_\sigma + \boldsymbol{\gamma}_\sigma \qquad \textbf{(13)}$$

and we conclude with the formulae:

$\mathbf{r} = \mathbf{R} - \mathbf{R}_0$ **(14)** where $\mathbf{r}$ is the position vector of point Σ which moves in space with respect to the point of the moving non-inertially Oxyz, $\mathbf{R}$ the position vector of the point Σ with respect to the point of the stationary Ωξπζ, $\mathbf{R_0}$ the position vector of point O of Oxyz with regards to Ω in Ωξπζ.

$$\mathbf{\upsilon}_\alpha = \mathbf{\upsilon}_0 + \boldsymbol{\omega} \mathrm{x} \mathbf{r} + \mathbf{\upsilon}_\sigma \quad \textbf{(15)}$$

where $\mathbf{\upsilon}_\alpha$ == absolute velocity of point Σ with respect to Ωξπζ.

$\mathbf{\upsilon}_0$ == velocity of O with respect to Ω

$\mathbf{\upsilon}_\sigma$ == velocity of Σ with respect to Oxyz

$\boldsymbol{\omega}$ == velocity of angular rotation of Oxyz.

And the derivative of $\mathbf{\upsilon}_\alpha$ with respect to time is

$$\boldsymbol{\gamma}_\alpha = \boldsymbol{\gamma}_0 + \boldsymbol{\omega} x(\boldsymbol{\omega} x \mathbf{r}) + \dot{\boldsymbol{\omega}} x \mathbf{r} + \mathbf{2}\boldsymbol{\omega} x \mathbf{\upsilon}_\sigma + \boldsymbol{\gamma}_\sigma \qquad \textbf{(16)}$$

where $\boldsymbol{\gamma}_\alpha$ = absolute acceleration of moving point Σ with respect to the inert Ωξπζ.

$\boldsymbol{\gamma}_0$ = acceleration of O with respect to Ω

$\boldsymbol{\gamma}_\sigma$ = relative acceleration of Σ with respect to Oxyz

$\boldsymbol{\omega} x(\boldsymbol{\omega} x \mathbf{r})$ = centripetal acceleration of Σ with respect to Oxyz which revolves at angular velocity ω.

and $\dot{\boldsymbol{\omega}} x \mathbf{r}$ is the change in angular velocity of Oxyz by vector $\mathbf{r}$.

As for $\mathbf{2}\boldsymbol{\omega} x \mathbf{\upsilon}_\sigma$ we have not found what the acceleration in the inert frame system is.

Therefore, so that we may find out which forces are equal with the force which the observer in the moving non-inertial frame system receives, we take from formula (16)

$$\mathrm{m}\boldsymbol{\gamma}_{\sigma} = \mathrm{m}\boldsymbol{\gamma}_{\alpha} - m\boldsymbol{\gamma}_{0} - m\boldsymbol{\omega}x(\boldsymbol{\omega}x\mathbf{r}) - \mathrm{m}\dot{\boldsymbol{\omega}}x\mathbf{r} - 2\mathrm{m}\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma} \qquad \textbf{(17)}$$

Where $\mathrm{m}\boldsymbol{\gamma}_{\sigma} =$ the force which the observer in the non-inertial system accepts as in effect on the material point Σ **because it is hypothetical that there are hypothetical forces in the second part.**

$\mathrm{m}\boldsymbol{\gamma}_{\alpha} =$ the force exerted on the material point Σ and which is received by the observer in the stationary Ωξπζ.

$-\mathrm{m}\boldsymbol{\gamma}_{0} =$ is the force which the observer in the inert Ωξπζ accepts as being exerted on the non-inertial moving system Oxyz.

$-m\boldsymbol{\omega}x(\boldsymbol{\omega}x\mathbf{r}) =$ the centrifugal hypothetical force of the observer of Oxyz as exerted on Σ.

$-2\mathrm{m}\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma} =$ the hypothetical Coriolis force which the observer in Oxyz accepts as being exerted on Σ.

$-\mathrm{m}\dot{\boldsymbol{\omega}}x\mathbf{r} =$ the force which alters the rotation of Oxyz.

THE MISTAKES IN THE ABOVE END AN OTHER ANALYSIS

From the relationship (5): $\mathbf{A} = A_\chi \mathbf{e_1} + A_y\mathbf{e_2} + A_z\mathbf{e_3}$

Where vector A is that of the non-inertial system Oxyz, we proceeded to formula (8), especially:

$$\frac{d_\alpha \boldsymbol{A}}{dt} = (\dot{A}_x \boldsymbol{e}_1 + \dot{A}_y \boldsymbol{e}_2 + \dot{A}_z \boldsymbol{e}_3) + (A_x \dot{\boldsymbol{e}}_1 + A_y \dot{\boldsymbol{e}}_2 + A_z \dot{\boldsymbol{e}}_3) \quad \textbf{(8)}$$

The equation (5) is made equal to equation (4), which is:

$\mathbf{A} = A_\xi \boldsymbol{\varepsilon}_1 + A_\pi \boldsymbol{\varepsilon}_2 + A_\zeta \boldsymbol{\varepsilon}_3$ (4) and (5) is

$\mathbf{A} = A_\chi \mathbf{e_1} + A_y\mathbf{e_2} + A_z\mathbf{e_3}$

As supposed, the frame system Oxyz moves with respect to Ωξπζ. In this case, vector A **is not the same in both frame systems. If** A **is the velocity of a material point Σ with respect to Ωξπζ, the moving of observer Oxyz, which is moving with respect Ωξπζ at a velocity whose vector is represented by B, will observe point Σ of the system Oxyz as having a velocity not A, but A – B.**

We sould not use the same $\dot{\mathbf{A}}_x$, $\dot{\mathbf{A}}_y$, $\dot{\mathbf{A}}_z$ **in (7)** $\frac{\mathbf{d}_\sigma \mathbf{A}}{\mathbf{dt}}$ **and in (8)** $\frac{\mathbf{d}_\alpha \mathbf{A}}{\mathbf{dt}}$ **, because the change of them are different into two systems (inertial and non-inertial). It happens because Oxyz moves with acceleration with respect to Ωξπζ.**

Again $\mathbf{R} - \mathbf{R}_0 = \mathbf{r}$ so

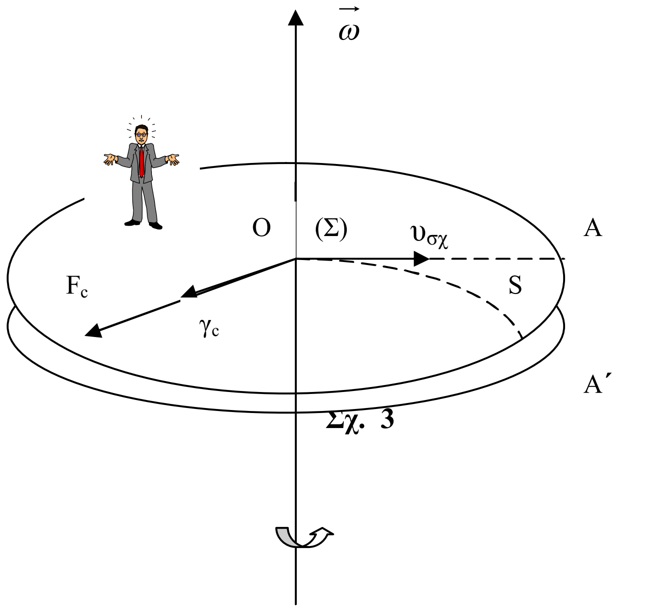
$$\frac{d\mathbf{r}}{dt} = \frac{d\mathbf{R}}{dt} - \frac{d\mathbf{R_0}}{dt} \Rightarrow \boldsymbol{\upsilon}_\sigma = \boldsymbol{\upsilon}_\alpha - \boldsymbol{\upsilon}_0 \quad \text{or} \quad \boldsymbol{\upsilon}_\alpha = \boldsymbol{\upsilon}_\sigma + \boldsymbol{\upsilon}_0$$

which is the transformation of Galileo and which we insist is in effect for non-inertial frame systems that have $\boldsymbol{\upsilon}_o$ **with respect to the inert.**

This means that the following formula is not valid: (11) $\boldsymbol{\upsilon}_\alpha = \boldsymbol{\upsilon}_0 + \boldsymbol{\omega} x \mathbf{r} + \boldsymbol{\upsilon}_\sigma$

In an easier analysis, since in the above way it was developed there is a mistake, then there will be a mistake in other ways (we find a mistake in the above analysis, so we will find an easier one in the following).

The theory and diagram is from "Mechanics" by E. Kouyoumtzopoulos on page 172.



Plan. 3

We have a smooth circular table in the above diagram with a radius R which is revolving with a stable angular velocity ω about its vertical geometric axis. An observer who takes part in the motion of the table throws an object of mass M from the centre O with a stable velocity as far as the table $\upsilon_{\sigma\chi}$ is concerned. The observer sees the orbit of the mass (sphere) which is not OA but OA', that is the curve of the system of the table.

If the table is not revolving, the sphere goes from O to A and the following formula is in effect: $(OA) = \upsilon_{\sigma\chi} \cdot t = R \Rightarrow t = \dfrac{R}{\upsilon_{\sigma\chi}}$ (A)

The observer revolving with the table sees the curved motion as velocity and Coriolis force which in our example is horizontal to the table. The sphere goes from A to $A' = S$ with $\gamma_c = \dfrac{F_c}{m}$ (B). Then, based on relationship (A) we have:

$$S = \frac{1}{2} \cdot \gamma_c t^2 = \frac{1}{2} \frac{F_c}{m} \cdot \frac{R^2}{\upsilon_{\sigma\chi}^2} \quad \text{(C)}$$

The arc S takes time t according to the observer, with a linear velocity $\upsilon = \omega.R$ (D), and according to the relationships (A) and (D)

$$S = \upsilon \cdot t = \omega R \frac{R}{\upsilon_{\sigma\chi}} = \frac{\omega}{\upsilon_{\sigma\chi}} R^2$$ and according to (C)

$$\frac{\omega}{\upsilon_{\sigma\chi}} R^2 = \frac{1}{2}\frac{F_c}{m} \cdot \frac{R^2}{\upsilon_{\sigma\chi}^2} \Rightarrow F_c = 2m\omega\upsilon_{\sigma\chi}$$ the Coriolis force.

However the orbit $\upsilon_{\sigma\chi}$ of the sphere has a curve of radius R′ and the velocity is $\upsilon_{\sigma\chi} = \omega' R'$ where ω′ is the angular velocity on the orbit curve and thus the Coriolis force is not proved.

That is, $\upsilon = \omega R$ is not in effect on the orbit of the body (the velocity of the body υ is different when the table is motionless from when the table revolves, since the orbit OA' has a different length from OA).

AN ATTEMPT AT FINDING THE CORRECT TRANSFORMATIONS.

We recall the equality of the vectors:

$$\mathbf{R} = \mathbf{R}_0 + \mathbf{r} \text{ and so } \frac{d\mathbf{R}}{dt} = \boldsymbol{\upsilon}_\alpha = \boldsymbol{\upsilon}_0 + \boldsymbol{\upsilon}_\sigma$$

which is Galileo's transformation, of the velocity of a point which is measured in an inert system υ_α at the velocity υ_0 of the non-inertial system plus the velocity of the point υ_σ in the non-inertial system. That is to say that we support the idea that the addition of velocities (Galileo's transformation) holds not only in inertial frame systems, but also for the motion of a body with respect to a non-inertial system which non-inertial system is referred to with respect to the inertial system.

In the special case where the vector of the relative velocity is vertical to the level of the vector of angular velocity and the vector of position, then we have:

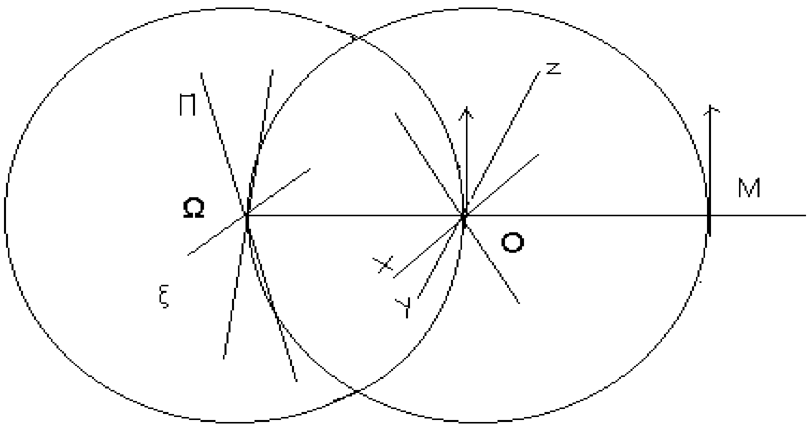
$\boldsymbol{\upsilon}_{\sigma} = +\boldsymbol{\omega} x \mathbf{r}$ (I) so

$\boldsymbol{\upsilon}_{\alpha} = \boldsymbol{\upsilon}_{0} + \boldsymbol{\omega} x \mathbf{r}$ (II) and $(\boldsymbol{\upsilon} = \boldsymbol{\upsilon}_{0} + \boldsymbol{\upsilon}_{\sigma})$ In the special case that the velocity is vertical to the level formed by the vertical vectors **ω** and **r,** we shall examine the following:

The formulae (II) and (III) must be proved, and we now examine a borderline case to do this.

and $\boldsymbol{\gamma}_{\alpha} = \boldsymbol{\gamma}_{0} + \dot{\boldsymbol{\omega}} x \mathbf{r} + \boldsymbol{\omega} x \boldsymbol{\upsilon}_{\sigma}$ (III)

We consider a frame system Ωξπζ as inert, and material point O on a Cartesian co-ordinate system Oxyz. O is in a non-inertial frame system which rotates at a regular angular velocity +ω around Ωξπζ at a radius R=ΩO.



plan. 4

We consider a material point M which revolves around Oxyz at velocity +ω and radius $\mathbf{r}$ = OM = $\mathbf{R}$ = ΩO. Then the point M is alays at the same radius with respect to Ωξπζ. Then according to the formulae we gave the following is in effect:

$$\boldsymbol{\upsilon}_{\alpha} = \boldsymbol{\upsilon}_0 + \boldsymbol{\omega} x \mathbf{r} = +\omega R + \omega r = +2\omega R = +\omega(\Omega M)$$

is the kinetic velocity of the point M since $\dot{\boldsymbol{\omega}} \mathrm{x} \mathbf{r} = 0$

$$\boldsymbol{\gamma}_{\alpha} = \boldsymbol{\gamma}_0 + \dot{\boldsymbol{\omega}} x \mathbf{r} + \boldsymbol{\omega} x \boldsymbol{\upsilon}_{\sigma} = \omega^2 R + \boldsymbol{\omega}(+\boldsymbol{\omega} r) \quad \Rightarrow$$

$$\boldsymbol{\gamma}_{\alpha} = \omega(\boldsymbol{\omega} R + \upsilon_{\sigma}) = \omega(\boldsymbol{\upsilon}_0 + \boldsymbol{\upsilon}_{\sigma}) \quad \Rightarrow$$

$$\boldsymbol{\gamma}_{\alpha} = \omega \boldsymbol{\upsilon}_{\alpha} = \omega 2R\omega = 2\omega^2 R = \omega^2(\Omega M)$$

is the acceleration.

In the same case, the at present classical physics gives

$\boldsymbol{\upsilon}_{\alpha} = \boldsymbol{\upsilon}_0 + \boldsymbol{\upsilon}_{\sigma} + \boldsymbol{\omega} x \mathbf{r}$ and since $\upsilon_{\sigma} = +\omega r$

$$\boldsymbol{\upsilon}_{\alpha} = +\omega \cdot R + \omega r + \omega r \quad \Rightarrow \quad \boldsymbol{\upsilon}_{\alpha} = +3\omega \cdot r = 3\omega R$$

that is $\boldsymbol{\upsilon}_{\alpha} = 3\omega \cdot r = \frac{3}{2}\omega(\Omega M)$ which is wrong.

Also, $\boldsymbol{\gamma}_{\alpha} = \boldsymbol{\gamma}_0 + \boldsymbol{\gamma}_{\sigma} + \boldsymbol{\omega} x(\boldsymbol{\omega} x \mathbf{r}) + \dot{\boldsymbol{\omega}} x \mathbf{r} + 2\boldsymbol{\omega} x \boldsymbol{\upsilon}_{\sigma}$

Since ω = stable, $\boldsymbol{\upsilon}_{\sigma} = +\boldsymbol{\omega}\mathbf{r}$, the following is in effect

$$\boldsymbol{\gamma}_{\alpha} = \omega^2 R + \omega^2 r + \omega^2 r + 2\omega^2 r = 5\omega^2 R = \frac{5}{2}\omega^2(\Omega M)$$

which result is also wrong.

Thus we see that in this example of an experiment, the formulae which we deduce with respect to velocity and acceleration are confirmed. Classical physics does not describe the phenomenon with the transformations of velocity and acceleration, which it gives.

From transformation (III) it follows that the forces

$$m\boldsymbol{\gamma}_{\alpha} = m\boldsymbol{\gamma}_{0} + m\dot{\boldsymbol{\omega}}x\mathbf{r} + m\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma} \qquad \text{(IV)}$$

Here we are in an inertial frame system and we find that the force exerted on a point in space is equal to the force exerted on a non-inertial frame system, the force which modifies the rotation of the non-inertial system and the force $-m\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma}$. This last force is positive in the inert system. We do not find centripetal acceleration of the point in the inert $(\boldsymbol{\omega}x\boldsymbol{\omega}x\mathbf{r})$ formula (16).

That is to say that we do not find centripetal acceleration of the point with respect to the non-inertial system, and consequently we do not find centrifugal force on the point in the non-inertial system when we solve equation (16) with respect to $\boldsymbol{\gamma}_{\sigma}$.

$\boldsymbol{\gamma}_{\sigma}$ **,** the acceleration that the observer in the non-inertial system observes in the moving body, is : $\boldsymbol{\gamma}_{\sigma} = +\dot{\boldsymbol{\omega}}x\mathbf{r} + \boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma}$ (V)

ANALYSIS OF THE FORCES.

The fact that we found that:

$$m\boldsymbol{\gamma}_{\alpha} = m\boldsymbol{\gamma}_{0} + m\dot{\boldsymbol{\omega}}x\mathbf{r} + m\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma} \qquad \text{(IV)}$$

prevents the entering of the centripetal force into the analysis (in the second part of the equation, as in formula (16).

We also find that $\boldsymbol{\gamma}_{\sigma} = +m\dot{\boldsymbol{\omega}}x\mathbf{r} + m\boldsymbol{\omega}x\boldsymbol{\upsilon}_{\sigma}$

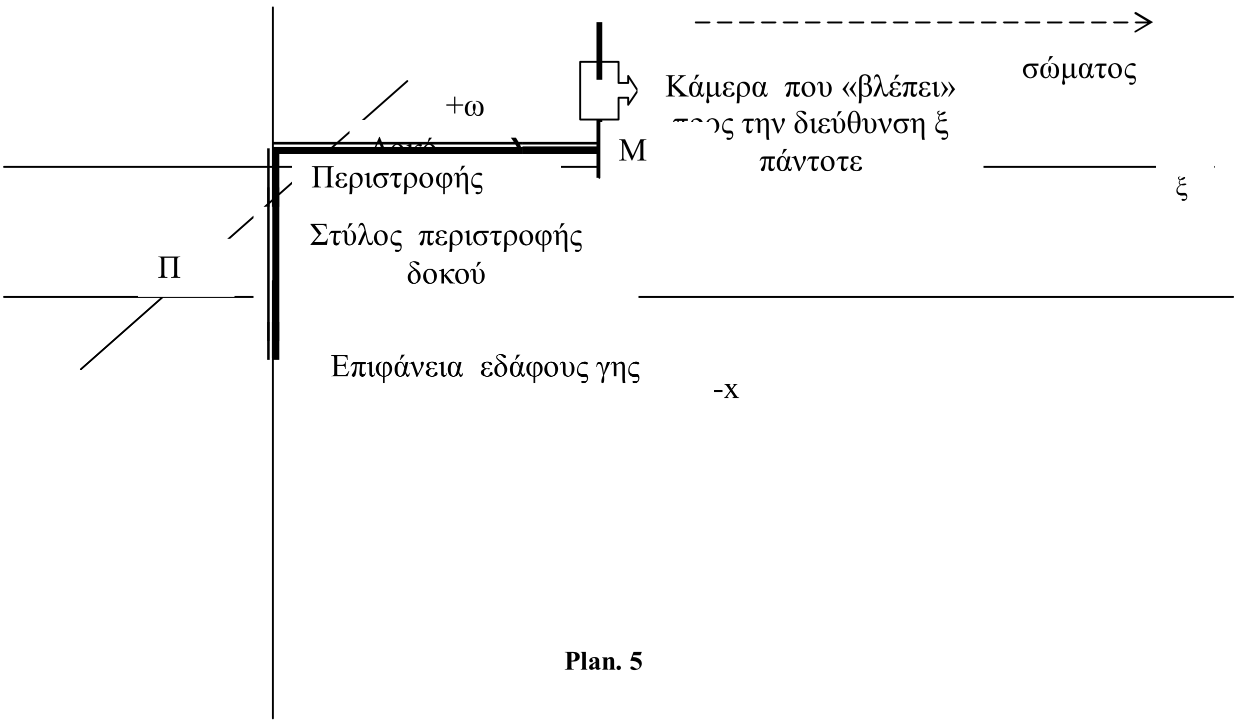
Then in $\boldsymbol{\gamma}_{\sigma} = \boldsymbol{\gamma}_{\alpha} - \boldsymbol{\gamma}_{0}$ **there is no centrifugal force, it does not exist anywhere.**

When $\boldsymbol{\gamma}_0 = \boldsymbol{\omega} x \mathbf{R}$, that is that there is centripetal force with respect to the inertial system, which has point O of the non-inertial system, **then there are no pseudo-forces in nature, centrifugal and Coriolis, only the centripetal is able to describe the phenomena and if this enters the other part of the equation, it becomes negative (centripetal).**

The centripetal force is that which turns the point from a straight motion. The observer on the body recognises that it is moving in a preferential system (e.g. earth) and then the outward pull that the non-inertial observer feels is the tendency of the body to follow a straight line, from which it wanders because of the centripetal force which moves in relation to the preferential system.

BORDERLINE CASE; THE MOTION FROM A NON-INERTIAL SYSTEM WHICH HAS Ω, R+ STABLE WITH RESPECT TO THE INERTIAL SYSTEM AND THE POINT HAS A STABLE STRAIGHT MOTION IN THE INERTIAL SYSTEM.

This is the case referred to in the lecture in Ioannina.



Plan. 5

We consider a beam $\Omega M = R$ which revolves at angular velocity ω with respect to the inert Ωξπζ. We consider the self-rotation of a camera at point M as zero. In Ωξπζ it is in effect for a body sent out at velocity υ:

We have: $\mathbf{R} = \mathbf{R}_{\xi} + \boldsymbol{\upsilon} \cdot t$

where $\mathbf{R}$ = the vector of the position of the body in Ωξπζ.

$\mathbf{R}_{\xi}$ = the initial condition of the launch of the body

$\boldsymbol{\upsilon}$ = velocity of the body.

The transformation of the velocities we found is

$$\boldsymbol{\upsilon}_{\sigma} = \boldsymbol{\upsilon}_{\alpha} - \boldsymbol{\upsilon}_{0}$$

In this case $\boldsymbol{\upsilon}_{\alpha} = \boldsymbol{\upsilon}_{0_{\kappa}} + \boldsymbol{\gamma}_{\alpha} t$ and

$\boldsymbol{\upsilon}_{0}$ = velocity (of rotation) of the non-inertial with respect to the inert.

$\boldsymbol{\upsilon}_{0_{\kappa}}$ = initial velocity of the body in the inert

and $\boldsymbol{\upsilon}_{0} = \boldsymbol{\omega} \cdot \mathbf{R} = \omega \cdot R$ wherefore

$$\boldsymbol{\upsilon}_{\sigma} = \boldsymbol{\upsilon}_{0_{\kappa}} + \boldsymbol{\gamma}_{\alpha} t - \omega R$$

The velocity must be analysed on the two axes of the co-ordinates of the inert system, i.e.

$$\Pi = R\cos(\omega t - \varphi)$$

$$\Xi = R\sin(\omega t - \varphi) \quad \text{and}$$

On the axis π: $\boldsymbol{\upsilon}_{0_{\pi}} = -\omega R\sin(\omega t - \varphi)$

On the axis ξ: $\boldsymbol{\upsilon}_{0_{\xi}} = +\omega R\cos(\omega t - \varphi)$, so

on the axis ξ the velocity will be

$$\boldsymbol{\upsilon}_{\sigma_{\xi}} = \boldsymbol{\upsilon}_{0_{\kappa}} + \boldsymbol{\gamma}_{\alpha} t + \omega R\cos(\omega t - \varphi) \quad \text{and} \quad \gamma = 0$$

on the axis π the velocity will be

$$\boldsymbol{\upsilon}_{\sigma_{\pi}} = -\omega R\sin(\omega t - \varphi)$$

and $\boldsymbol{\upsilon}_{\sigma} = \boldsymbol{\upsilon}_{\alpha} - (\boldsymbol{\upsilon}_{\sigma_{\xi}} + \boldsymbol{\upsilon}_{\sigma_{\pi}})$ (VI)

This is the transformation of the velocities.

We point out that the velocity in the inert system is stable and since the body was launched horizontally, the energy, momentum and angular momentum are preserved in the inertial system. (The laws of conservation are in effect in the system.)

However, the transformation (IV) is in effect in the non-inertial system. The velocities $\boldsymbol{\upsilon}_{0_{\xi}}$ and $\boldsymbol{\upsilon}_{\sigma_{\pi}}$ change harmonically, and $\boldsymbol{\upsilon}_{0_{\xi}}$ is added to $\boldsymbol{\upsilon}_{\alpha}$, since it supervenes on the same axis as $\boldsymbol{\upsilon}_{\alpha}$ and $\boldsymbol{\upsilon}_{\sigma_{\pi}}$ is added.

The motion which formula (IV) describes, describes the transformation of velocities which an observer on the non-inertial system estimates (here the camera).

The velocity changes, consequently the energy is changeable, therefore energy, momentum and angular momentum are not stable.

Then for the non-inertial observer, the laws of nature are not in effect, consequently the systems are not equivalent, and therefore the axiom-law of light is not in effect. The velocity of light is not the same in the two systems, therefore the theory of relativity cannot be created and there are preferential systems in nature.

CONCLUSIONS

The above analysis presupposes a inertial frame system (which is also called preferential) in relation to which the motions are referred. In this system there is the centripetal force of the moved non-inertial system.

The motion at the third body in relation to the non inertial frame system as well as the inert is connected with the transformation of Galileo.

In such an analysis there is not the force Coriolis as it has been stated by science and we have given above the solutions in boundary conditions.

There is not a centrifugal force but there is a negative centripetal force which may have the non inertial system depending on which side of the equation it will be appear.

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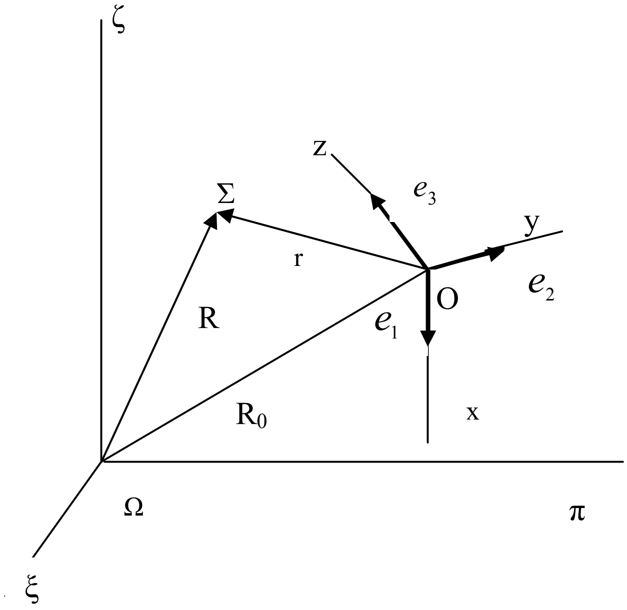
PLANS



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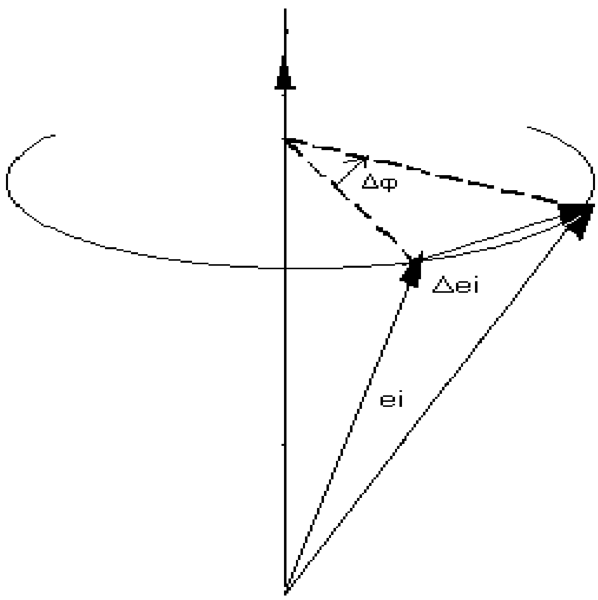

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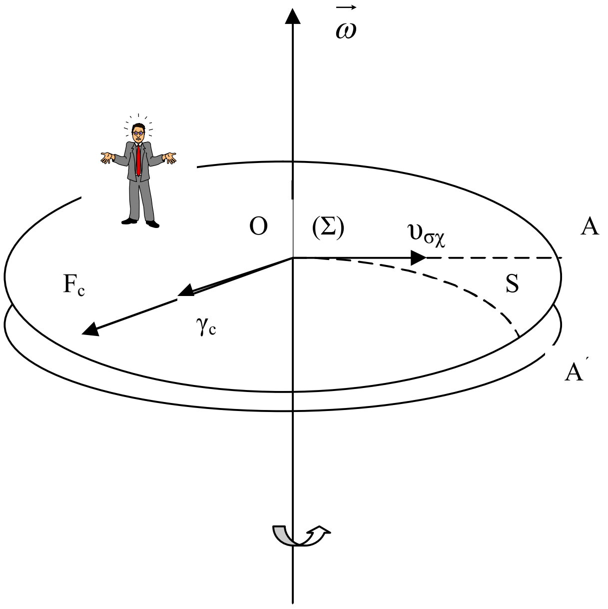
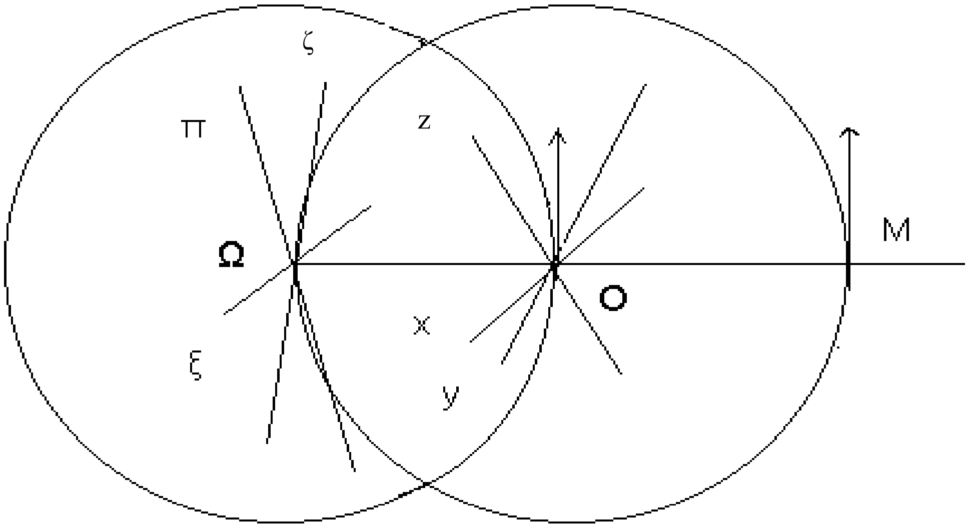
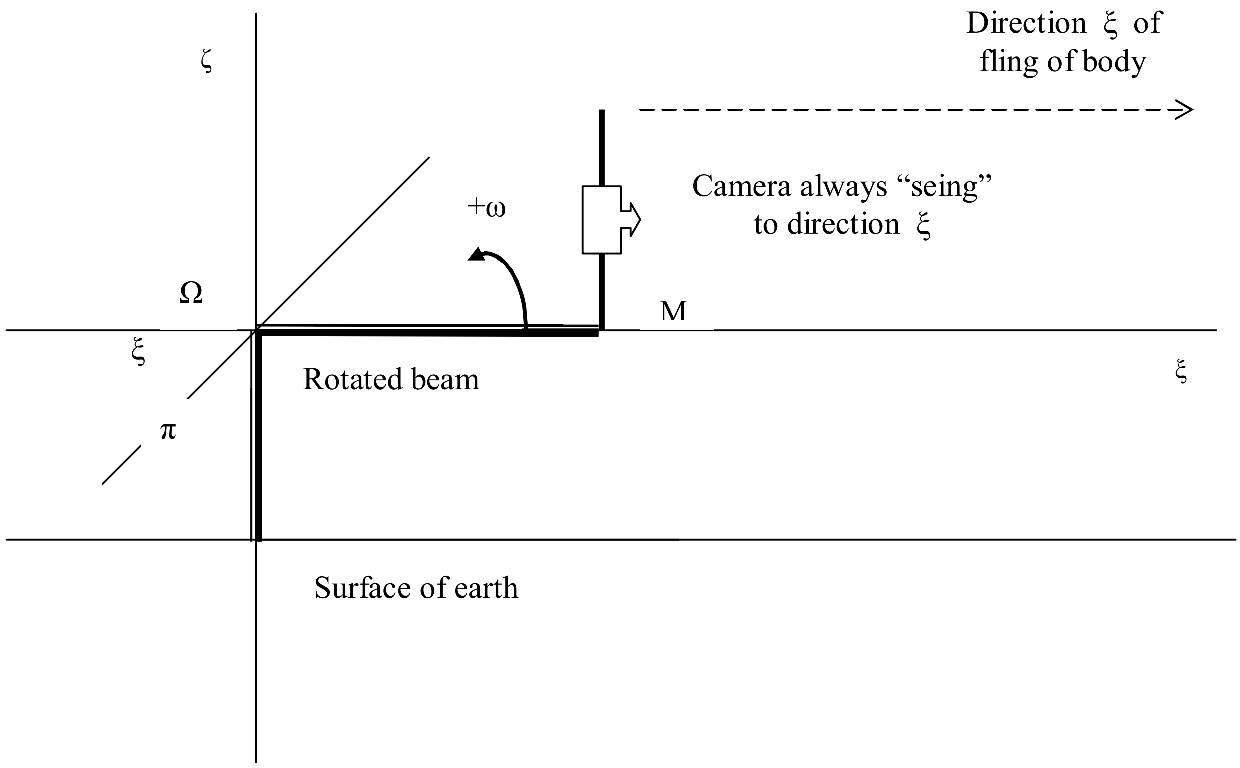


Plan. 3

Plan. 4




Direction ξ of
fling of body
ζ
Camera always "seing"
to direction ξ
+ω
Ω
M
ξ
Rotated beam
ξ
π
Surface of earth

Plan. 5