Journal of
Applied & Computational Mathematics

Yu, J Appl Computat Math 2015, 4:3
DOI: 10.4172/2168-9679.1000222

Research Article Open Access

New Rotational Dynamics- Inertia-Torque Principle and the Force Moment the Character of Statics

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Abstract

Textual point of view, generate in a series of rotational dynamics experiment. Initial research, is wish find a method overcome the momentum conservation. But further study, again detected inside the classical mechanics, the error of the principle of force moment. Then a series of, momentous the error of inside classical theory, all discover come out. The momentum conservation law is wrong; the newton third law is wrong; the energy conservation law is also can surpass. After redress these error, the new theory namely perforce bring. This will involve the classical physics and mechanics the foundation fraction, textbooks of physics foundation part should proceed the grand modification.

Keywords: Rigid body; Inertia torque; Centroid moment; Centroid arm; Statics; Static force; Dynamics; Conservation law

Introduction

Textual argumentation is to bases on the several simple physics experiment, these experiments pass two videos the document to proceed to demonstrate. These two videos are:

1. Experiment testify momentum is not conservation;

2. The experiment of physics of mechanics of the Inertia-torque. Also still have relevant the article in go along to explain and discusses

Figures 1 and 2 is these two videos the pictures respectively. Figure 1 the experiment the show, is do concerning momentum is not conservation one earliest experiment. On this foundation the passage deepen the research, just so it become this textual a standpoint and succession completed such as the Figure 2 the experiment. Textual point of view primarily is from Figures 1 and 2 the experiment generates. Therefore textual argumentation is having the experiment the evidence and sustaining, don't is simple reasoning or hypothesis or conjectures [1].

The Notion the Inertia-torque

Inertia-torque is objected inertial mass and the arm of force the product.

Why can save labour it the lever? The moment of force really do to force the change? Does it nope to the object burthen the mass occurrence change? The Inertia-torque, namely, such as Figure 3 the show, the particle m (the m is also its mass) is a r 1 to O the slewing radius, so it the Inertia-torque is:

$$I = m.r_1 \tag{1.1}$$

The Inertia-torque is similar with moment of force, to the same of origin, it is a constant. So by the origin the other derivation vector, for example r 2 in graph, namely must proceed the change [2].

$$\text{If } r_2 = qr_1 \text{ well then } I = m.r_1 = \frac{m}{q}.r_2 \tag{1.2}$$

Therefore here m, namely, minish multiple of q. It is an inverse proportion to r the vector quantity change multiple.

So, Inertia-torque is that product to that object mass and force

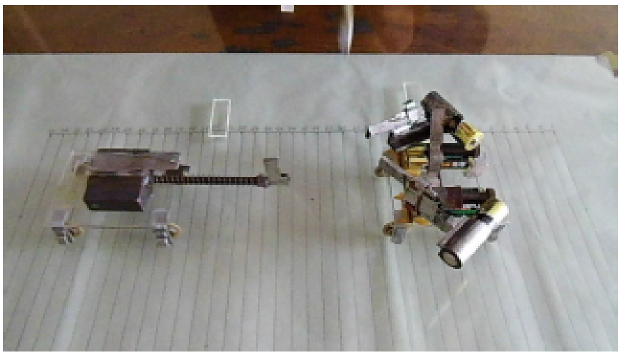

Figure 1: Experiment testify momentum is not conservation.

Figure 2: The experiment of physics of mechanics of the Inertiatorque.

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Received March 03, 2015; **Accepted** April 25, 2015; **Published** May 02, 2015

Citation: Yu G (2015) New Rotational Dynamics- Inertia-Torque Principle and the Force Moment the Character of Statics. J Appl Computat Math 4: 222. doi:10.4172/2168-9679.1000222

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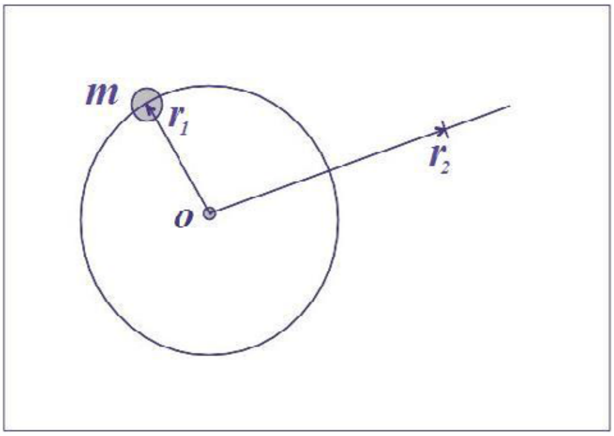

Figure 3: Concerning Inertiatorque.

arm. It of true meaning, in fact be the place end in force arm, that to two sides tangent line the direction, by the inertial mass of the object. Therefore, it can be calculated from the Inertia-torque, at direction of tangent line the mass of object.

Such as the correspondence in Inertia-torque I = m.r_1

Its direction of tangent lines the mass, namely $m = \dfrac{I}{r_1}$ (1.3)

But the correspondence in the r_2 of the formula (1.0.2), the direction of tangent lines the mass:

$$m_2 = m.\frac{I}{q} = \frac{I}{r_2}$$

Therefore the formula (1.0.3) and the formula (1.0.4) is not the similar. The crux is discriminative at both, the m of mass of the formula (1.0.3), is the mass of the actual particle in object; But the m2 of mass of the formula (1.0.4), it is on the different force arm, to the m the mass the inverse proportion mapping. It is not actual particle. Therefore in an object, arbitrarily the Inertia-torque of the force arm of the vector quantity the tangential mass, are all may be true mass, or is not true mass the mapping mass.

M= {m|m=I/r} M_m= {M_m|M_m=pm=I|(r/p)} $f : M \to M_m$

$m \to m_m$ M_m=f (m) =pm (1.5)

Inside the formula the m is true mass of the particle of the Inertia-torque, the mm is the mapping mass of particle of different force arm of the mapping of the Inertia-torque.

The mapping mass and true mass, the quality is different. True mass embodiment the object true exists, so it is in object, having the actual influence to the object the inertia. But mapping mass, it oneself is not really the ease. It merely is, when the object is action by the moment of force, present in a kind of inertial burthen. Therefore in the action of force it determined, from this a moment is to the force will be how big holdout in the inertia.

Because the mass the mapping on the moment of force, the actual is while there is external force the action, the performance is an inertial burthen, namely. So it is Inertia-torque a ingredient of the mass of burthen. The mass of burthen of the Inertia-torque, is to arbitrarily the arm of force of the object, it summation to the true mass and the mass of mapping. The Inertia-torque is to the inertial mark of the object rotation.

The experiment of inertia-torque

Figure 2 is a dynamics experiment the video photo [2], this experiment to become supported in theory of the Inertia-torque.

In this image, outer ring is a big picture, midst is a small picture. Two picture shoot use same equipment, the overlay in together is for mutually compare, with display the experiment the result [3].

Two the experiment is same device to use. Namely a stick form the revolution arm is can the agility rotation, has the certain mass; and a spring it can released in momentary by creation thrust. While experimenting released suddenly the spring, generate an impulse force, push the revolution arm to rapid circumvolved.

Two experiment, by exact adjust, do the spring push two revolution arm, the distances is same. Thereby, the spring thrusts to two revolution arm, also is same. It's different, is two revolution arms it one is in 1/2 arm the push, and one is in all arm the push [4].

The results of the experiment, from the image can firsthand acquisition. Two revolutions arm revolved with same angular acceleration and the angular velocity. This is versus Inertia-torque theory first hand and dependable sustain.

$$F_1 = m_1 a_1 = m.\frac{R\theta}{t^2} = m.R\beta \quad (1.1.1)$$

$$F_2 = m_2 a_2 = \frac{m}{2}.\frac{2R\theta}{t^2} = \frac{m}{2}.2R\beta \quad (1.1.2)$$

Inside the formula, the θ is central angle turned by revolutions arm, the β is an angular acceleration. Therefore two experiments, the impulse force of the spring are the same. But its burthen mass differs is doubled, the inverse ratio of linearity acceleration differs is doubled; only the angular acceleration is same.

State explains the experiment and Inertia torque formula the (1.0.1) and (1.0.2) etc. is parallelism, testified the Inertia torque theory is exactitude. But more important, was this experiment to negated, in classical theory the "moment of inertia" and" law of rotation of rigid body", etc. The rotational dynamics of the physics need do the importance modification [5].

The total Inertia-torque of the rotational rigid body

The rigid bodies of the fixed axis rotation have affirmatory Inertia torque. Namely, the formula (1.0.1) and formula (1.0.2), etc.

But ordinary rigid body, usually be constituted by a lot of particles. Certainly among them each a particle, regardless it is how many magnitude vectors, also that is certain have an Inertia-torque. Such as formula (1.0.1) etc. But at rigid body the Inertia-torque of each a particle, it is a constant. Be namely When the vector magnitude change. The mass of its mapping, will is the inverse ratio the change. So its Inertia-torque is not because the vector the change. Therefore, because this reason, do that all particle in inside in a rigid body the Inertia-torque, to directly plus, can get the total Inertia-torque of that rigid body. Here whether is directly the Inertia-torque of the particle, or is the Inertia-torque of the mapping mass, will match its total Inertia-torque in any vector [6].

So when a rigid body of fixed axis rotation, be constituted by some particles that each particle, have a mass the m_i, and the force arm r i of to the shaft. So the total Inertia-torque of this rigid body is:

$$I_{all} = m_1 r_1 + m_2 r_2 + ... + m_n r_n = \sum m_i r_i \text{ v} \quad (1.2.1)$$

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The centroid-moment of the slewing rigid body

The total Inertia-torque of the slewing rigid body is:

$$I_{all} = \sum m_i r_i \quad (1.3.1)$$

Namely:

The formula I c represents the centroid-moment namely.

We have obviously:

$$R_c = \frac{(\sum m_i r_i)}{M_{all}} \quad (1.3.3)$$

Namely total Inertia-torque I_{all} by total mass M_{all} divide, income force arm R_c, is unique force arm to that rigid body centroid-moment I_c a correspondence. Because the R_c is exclusive, therefore will it centroid-arm its definition. By the centroid-arm a end, do the circle or curves the line, it is represents the rotation center of mass line of the rigid body.

The total Inertia torque of the rigid body is a constant. Thereby but centroid arm R_c, any other force arm r_i.

It's all:

$$I_{all} = M_t . r_t = \sum m_i r_i \quad (1.3.4)$$

$$M_t = \frac{(\sum m_i r_i)}{r_t} \quad (1.3.5)$$

In formula the r t is a force arm but R_c, M_t is relatively in total Inertia torque I_{all} and force arm r_t, the total burthen mass of equivalent of the force. The total burthen mass is an reference, corresponding rigid body one force arm, the mass of it's the all particles of the circumference; and rigid body all particles of other part, mapping to the summation of all mass of this force arm.

$$m_t = \sum_{i=1}^{all} m_i \sum_{r=1}^{all} m_r \quad (1.3.6)$$

Inside the formula m i it's on circumference that true particle the mass, the m r is other region of rigid body the mapping mass of particles.

From formula (1.3.5) then, on the slewing rigid body, if the force arm differs, the total burthen mass of the end of force arm, for the inverse proportion change of the force arm change. Then force arm if change Q multiple, the mass of total burthen to change 1/Q multiple. Force arm if increase, the mass of total burthen is minish. Vice versa. Therefore in rigid body different force arm end, the mass of total burthen is different.

Therefore, be the r_t at the $>R_c$, or $<R_c$ it of both sides change. For example at $r_t < R_c$ and tends to infinity, the M tends to zero. Whereas when the $r_t < R_c$ and tends to infinitesimal, the M_t tends go infinity. Back a kind, is the force arm tends to 0, the equal force to through the shaft, therefore regardless the force is how big, the shaft also can't screw.

The formula (1.3.5) enunciation, in arbitrarily slewing rigid body, take the aleatoric force arm, the correspondence in the end of its force arm, all are one confirm the mass of rotation burthen. For example the formula (1.3.6) is the mass of total burthen namely. In rotation of rigid body, it's the mass of burthen of rotation and by the mass of reality of object be equivalent. It's via measure of mechanics to measure.

The principle of inertia-torque

Arbitrarily the rigid body of rotation of fix shaft, all is one decided parameter I_{all} for the Inertia-torque.

$$I_{all} = m_1 r_1 + m_2 r_2 + \ldots m_n r_n = \sum m_i r_i \quad (1.4.1)$$

Therefore, it's in rigid body that all particle the mass and force arm to the product the summation. It is a constant to this rigid body. From it to divide arbitrarily the R of the force arm, namely gained the rigid body of in force's arm the tangent direction burthen mass

$$\frac{I_{all}}{R} = \frac{\sum m_i r}{R} = M_R \quad (1.4.2)$$

In formula, the $\mathbf{M_R}$ been by force arm **R**, that rigid body tangent the direction burthen mass. From the level of the dynamics, the $\mathbf{M_R}$ in the force arm **R** tangent direction, match in the Newton second law. Namely:

$$F = ma = M_R . \frac{R\theta}{t^2} = M_R R . \frac{d\theta}{dt^2} = M_R R . \beta \quad (1.4.3)$$

The Inertia-torque in rotational dynamics is an object by concerning measure of the inertial. It has been really, and for attribute of dynamics of the object, by definite constraint effect parameter.

The Attribute of Statics of the Force Moment

The moment of force is the concept of a kind of statics, it in the dynamics use will cause mistake. For example some simple machinery and the machinery scale that weigh for example. Such as the Figure 4 shows, is the principle of a machinery scale or lever. In figure on the fulcrum O of the lever L, it's in both sides of lever L to the length and the weight of object, make it retain the equipoise. The principle of the moment of force is applicable to the Static force in the statics only. When the force in its point of action, engender pressure, but it in the reference frame is Stillness, it is

$$F_q = i.(\mathrm{m.a}) = \mathrm{i.(m.}\frac{d^2 l}{dt^2}) \quad (2.0.1)$$

Static force. Therefore, namely:

Because, Static force the $\mathbf{F_q}$ can produce the pressure, but have no the displacement, so it is a force of imaginary number [7,8].

But, if the motion of the force, match the condition of the statics equilibrium [9], namely it is the motion but has no acceleration. Then it still is the Static force. Namely:

$$F_q . S = (i.\mathrm{m.a}).\mathrm{S} = (\mathrm{i.m.}\frac{d^2 l}{dt^2}).\mathrm{S} \quad (2.0.2)$$

So, the Static force in by the product of its motion distance, equal

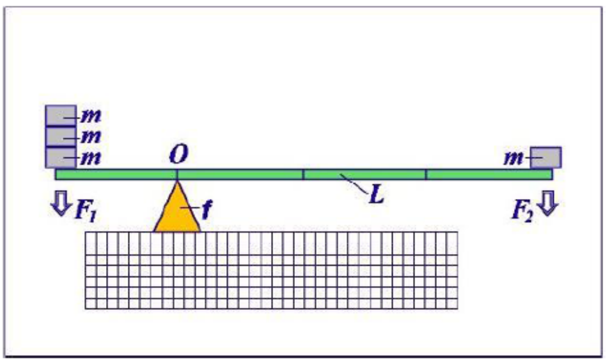

Figure 4: Moment of force in the statics.

the Static force to does a work. This by in dynamics the force to do work is alike. But it's the motion has no acceleration. The Static force does the work in mechanics the is not few, for example, be the force push the object, overcoming the friction force to motion, is a Static force to make the work.

The action of the Static force by is match the moment of force principle. For instance, in equal to zero of vector summation of complete external force moment, object is in state of the equilibrium, it also in state of the stillness, thereby here the force is Static force. So:

$$\tau = \tau_1 + \tau_2 + ... = F_1 r_1 + F_2 r_2 + ... = 0 \tag{2.0.3}$$

But if $\tau_1 + \tau_2 = F_1 r_1 + F_2 r_2 = 0$ then $\tau_1 = F_1 r_1 = \tau_2 = -F_2 r_2$ (2.0.4)

State the force moment τ_1 and τ_2 direction is reverse. But when force moment direction reverse, the force (force moment) resists mutually, thereupon its action is that quiescence, namely enunciation is a Static force status action.

Therefore states, the principle of force moment in fact is a kind statics principle. It is applicable to the Static force only. Thereupon pass the change of the force arm, can vary the big or small of the force, in fact only have the Static force.

Static force that conform the statics, have in the physics mechanics a good many. As long as is in quiescence or equilibriums, can generate to pressure the force, all is the Static force. For instance gravity, friction and electromagnetism the force, and the water pressure etc., these forces all are the Static force. All can is via varying the force arm, by the bulk of the change force. But it is in stillness, or in equilibrium state (namely uniform motion status) to the realization.

So, force moment principle at, reverse direction force moment to mutual withstands, or in force moment by equilibrium state run from Static force, that just be applicable.

The inertia of the object, namely inertial mass, in dynamics, is tantamount to a kind space restriction force. It obviously too is a kind Static force. Therefore inertia and mass of object, conform in the principle of force moment. Here its actual performance is an Inertia torque. Namely inertia and mass change because of the changes of the force arm.

When the action of the force makes the movement status occurrence change of the object. In dynamics action, does the principle of force moment be applicable? Answerback is, in the statics be applicable, not be necessarily in dynamics applicable. Because the condition of the mechanics, already occur the essences and very big the change. Thereupon, rigid body in the classical mechanics the rotation law, the facto is wrong.

The Characteristics of Dynamics of Inertia-torque Principle

Because the principle of Inertia torque, any rotational object all had the new dynamics the characteristics.

The linear momentum of the rotation rigid body and every kind of angular momentum

The total Inertia-torque of the slewing rigid body is this:

$$I_{all} = m_1 r_1 + m_2 r_2 + ... + m_n r_n = \sum m_i r_i \tag{3.1.1}$$

If the angular velocity of the slewing rigid body is a ω, then its rotation linear momenta is that:

$$P_1 = (\mathrm{M_{all}} . \mathrm{R_c}).\frac{d\theta}{dt} = (\mathrm{M_{all}} . \mathrm{R_c}).\mathrm{w} = (\sum m_i r_i).\frac{d\theta}{dt} = (\sum m_i r_i).\mathrm{w} \tag{3.1.2}$$

We awareness, the $M_{all} \cdot R_c$ is equal to the total Inertia-torque a I_{all}, is a constant. Then for a slewing rigid body, at it's the angular velocity the ω is ascertains, then it's the rotation linear momenta is a P_l, it is also a certainty quantity. Namely such as above formula (3.1.2).

On a slewing rigid body, its Inertia-torque is a constant. Thereupon, take regardless how big of force arm an R, it rotation versus the mass an M the burthen, all by inverse ratio change. The fore this reason Inertia-torque hold is constant. So at angular velocity a ω is certain, its rotation linear momenta are also a hold changeless. Regardless is in this slewing rigid body that, the random force arm (namely random radius R), its rotation linear momenta is all same.

Namely: $P_1 = (\frac{1}{P}.\mathrm{M_{all}}).(\mathrm{p}.\mathrm{R_c}).\mathrm{w}$ (3.1.3)

The angular momentum of the as to rotation rigid body, it took place a kind of strange change. Concerning the definition of the angular momentum, it is the object encircles the circular motion the line momentum, with its rotation radius by the product. But because Inertia torque principle, a rotation rigid body arbitrarily the rotation line momentum (include the mass of the true particle and the mass of the other radius particle of the mapping) of the radius, is all same. When the angular velocity ω is certain, it is a constant. Therefore, inside of former classical mechanics, total angular momentum of rigid body, is in rigid body that all particle the angular momentum the summation. For example the expression below:

$$L_{all} = l_1 + l_2 + ... + \mathrm{l_n} = \sum_{i=1}^{i=n} l_i \tag{3.1.4}$$

$$L_{all} = m_1.r_1^2.w + m_2.r_2^2.w + ... + m_n.r_n^2.w = \sum_{i=1}^{i=n} m_i.r_i^2.w \tag{3.1.5}$$

It is to don't be meaningful. Because, on differ the radius that particle the angular momentum at this time, the incapability is with accuracy to convert mutually. For example the angular momentum of the particle on the radius r_1 if convert to the radius r_2:

Suppose $r_1.\alpha = r_2$ (3.1.6)

So

$$m_1.r_1^2.w \Rightarrow \left(\frac{m_1}{\alpha}.(\mathrm{r_1}.\alpha)^2.w = \frac{m_1}{\alpha}.r_1^2.\alpha^2.w\right) \tag{3.1.7}$$

The value of the angular momentum because the multiple were multiplied the square, therefore already taken place the change. With actual angular momentum in object, already different. Therefore be the rotation rigid body inside arbitrarily the angular momentum of the particle, if convert to the different radius, the angular momentum of it's a mapping has taken place the change. So as formula (3.1.5) the angular momentum the sum, been nonsense in fact.

But the angular momentum of the true particle in rigid body also is not significance without completely. Because when by an object or particle are on the rotation rigid body, the occurrence radial move. Original true angular momentum in that object or particle be as to it's at travel hereafter, the total angular momentum in rigid body changes, having got the decisive action. So to the total true angular momentum of the rigid body, can record for:

$$L_{all} = \{\mathrm{l_1 l_2 .....l_n}\} = \{(\mathrm{m_1}.\mathrm{r_1^2}.\mathrm{w}),(\mathrm{m_2}.\mathrm{r_2^2}.\mathrm{w}),....,(\mathrm{m_n}.\mathrm{r}_n^2.\mathrm{w})\} \tag{3.1.8}$$

It is a finite collection. But as the formula (3.1.5), to particle the angular momentum the sum, been nonsense. With this opposite, another kind show method should be:

$$L_{all} = m_1.r_1^2.w + m_2.r_2^2.w + ... + m_n.r_n^2.w = (\mathrm{x})\,\mathrm{mr}^2\, w \qquad (3.1.9)$$

It is rigid body all particle the angular momentum vector quantity the module total sum x, and angular momentum the unit the $mr^2\omega$.

Because a rotation rigid body for having particular revolving speed, it's arbitrarily the rotation line momentum of the force arm is all same. Therefore it had the concept of another angular momentum. Namely its rotation line momentum for having in particular, with the product of its various radius r.

$$L_{complex} = p_l.r = (\frac{1}{p}.\mathrm{r} = (\frac{1}{p}.\mathrm{M_{all}}).(\mathrm{p.R_c}).\mathrm{w.R} \qquad (3.1.10)$$

Inside the formula the **R** is can change, but the rotation line momentum $\mathbf{P_1}$ is unchanged. Therefore its correspondence in different radius **R**, there will be a series of angular momentum $L_{complex}$. Such angular momentum $L_{complex}$, call it as the composition angular momentum of the rigid body. Each a rigid body composition angular momentum $L_{complex}$, be constituted by a series of different value. And with radius R direct proportion.

New rigid body rotation law and forces at differ arm of force does the work

When external force is acted in slewing rigid body arbitrarily force arm, so it would angular acceleration change how? In classical mechanics, this circumstance was been the rotation law of the rigid body by the formulation [4], namely:

$$F.R = I.\beta = m.\frac{du}{dt}.r = m.r^2.\frac{dw}{dt} \qquad (3.2.1)$$

The I in the formula is to the point the moment of inertia, different from textual the Inertiatorque. According to the rotation law of the rigid body, the angular acceleration of the rigid body, with its resultant external force moment is direct proportion is shown as formula (3.2.1) namely. But this is wrong.

According for textual to the Inertia torque principle, in ascertained to total Inertia torque of a rigid body, correspondence in its different force arm R, its the mass of burthen the M is with the R inverse ratio change. Such as the formula (1.4.2).

$$\frac{I_{all}}{R} = \frac{\sum m_i r}{R} = M_R$$

According to circular motion of the particle, the line quantity and the angle quantity the relation of conversion [4].

$$U = R.w = R.\frac{d\theta}{dt} \text{ and } a = R.\beta = R.\frac{dw}{dt} \qquad (3.2.2)$$

The force makes particle creation line acceleration and angular acceleration is it:

$$F = m.a = m.\frac{du}{dt} \text{ and } F = m.a = m.\mathrm{R}.\beta = \mathrm{m.R}.\frac{dw}{dt} \qquad (3.2.3)$$

Therefore, the particle the line velocity and line acceleration and angular velocity and angular acceleration, with force arm R are inseparable. So for a rigid body of rotation, when its angular velocity and angular acceleration is ascertained, by dissimilar the force arm R the correspondence, its line velocity and line acceleration will is dissimilar. Namely at here its line velocity and line acceleration, will in the force arm R for direct proportion to change.

According to the formula (1.4.2), a slewing rigid body, it arbitrarily the arm of force the mass of burthen the M, are all to force arm R inverse ratio change. Namely its Inertia-torque is a constant.

$$\mathrm{I = M \times R = constant} \qquad (3.2.4)$$

But can also get from the formula (3.2.3), when the M and the R is certain, make sure the force of the size, also the angular acceleration it is engender make sure.

$$F = m.a = M_R.R.\frac{dw}{dt} \qquad (3.2.5)$$

This is very the geezer, because this show for a rigid body, it on the external force moment the action, by angular acceleration for producing, is with it's the external force of tangent line direction the size to direct proportion. But have nothing to do with the size its force arm. This completes subversion classical mechanics inside, the rotation law of the rigid body. This is in the Inertia-torque principle, new the rigid body rotation law. The (3.2.5) is the formula of new rigid body rotation law.

Therefore, regardless in any force arm (certainly it be unequal to the zero or infinity), to make a rigid body creation determinate a angular acceleration, the size of a force for needing is all uniform.

Certainly, the acting force makes slewing rigid body engender angular acceleration. Although in dissimilar the force arm, the size of the force is same. But correspondence in same impulse, the force a work for make also is dissimilar obviously.

For example: dp = Fdt and $dp_w = \left(M_R.R.\frac{dw}{dt}\right)dt = M_R.R.dw$ (3.2.6)

this is the impulse and angle impulse. And that: $A = \int Fdl$ (3.2.7)

this is the force a work for make. But L (is l) in the formula should for:

$$L = \int Udt \text{ and } du = \frac{d^2 l}{dt^2}.dt = \frac{dl}{dt} \qquad (3.2.8)$$

With the formula (3.2.5) opposite, the show when the force arm R is big, the burthen mass M R is small, but linear velocity should be big. Linear velocity U decision force F the motion quantity L the size, both in reality is a direct proportion relation (3.2.8). Therefore although is as big as the force, but when force arm R is big, the force F the motion quantity L also is big. So, the force will also make still greater a work.

So, the force makes rigid body rotation, in the dissimilar force arm, the size of the force is same. But the force make a work, when the force arm is big more, the work be also bigger.

Many multiple slewing's kinetic energy of the slewing rigid body

One slewing rigid body, when its rotation the angular velocity ω is certain, its rotation linear momentum, at arbitrarily the force arm R is all same.

$$P_1 = (\frac{1}{p}.\mathrm{M_{all}}).(\mathrm{p.R_c}).\mathrm{W} = \mathrm{m_r}.u_r \qquad (3.3.1)$$

It explains, when the force arm R at change, the rigid body burthen mass of this force arm in correspondence, by inverse proportion change with force arm R.

$$(\frac{1}{p}.\mathrm{M_{all}}).(\mathrm{p.R_c}).\mathrm{W} = (\frac{1}{p}.\mathrm{M_{all}}).(\mathrm{p.U_c}) = \mathrm{m_r}.u_r \qquad (3.3.2)$$

So, a slewing rigid body, at its different force arm R, its burthen mass m r and linear velocity u r, also change with the inverse ratio. When the force arm R is big more, the linear velocity u r also big more,

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but burthen mass m r is then small more. Vice versa.

There is a circumstance at this time, been no allow to neglect. According to the definition of the kinetic energy of the object, the kinetic energy of the object is it:

$$E\frac{1}{2}mu^2 \text{ and } E_R = \frac{1}{2}mr^2w^2 \tag{3.3.3}$$

So the formulas (3.3.2) and (3.3.3), the slewing rigid body the burthen mass "m" and force arm "r" and linear velocity u, change with the inverse proportion. But in compute of kinetic energy, the mass m is a linear function, the force arm r and linear velocity u but a quadratic function. Thereupon, at condition same, namely same slewing rigid body and same rotation angular velocity ω, it in variant force arm r, slewing kinetic energy is diverse.

$$\frac{1}{2}m.r^2.w^2 < \frac{1}{2}.\frac{1}{p}.m.p^2.r^2.w^2 \tag{3.3.4}$$

Therefore, the change in magnification of the force arm r by to second power. So, on a slewing rigid body, when it's the rotation radius be big more, its rotation linear velocity second power also be big more, thereupon its slewing kinetic energy is also big more.

So, any a slewing rigid body, its slewing kinetic energy, don't is a single value. It also has the multiply slewing kinetic energy. It's slewing kinetic energy, at its rotation radius from small arrive the big that differs place, will display to be more and bigger.

$$\left(E_{R1} = \frac{1}{2}mr^2w^2\right) \Leftrightarrow \left(E_{R2} = \frac{1}{2}.\frac{m}{p}.p^2r^2w^2 = E_{R1}.p\right) \tag{3.3.5}$$

That' a slewing rigid body has the multiply slewing kinetic energy, this a circumstance challenged the energy conservation law. Because, at need pass the collision, make slewing rigid body stop turned. Then in rotation radius small and rotation radius big the place, will emit fewness and many two kind heat energy. An object, it's the kinetic energy has fewness and many, differ circumstance. This be with the energy conservation law, the energy creation can't too can't disappear, been may from a form conversion is another form ambivalent. Because when the energy of the object, there is multiple values, be so it converts another form of energy; certainly be can the fewness and the many. So in this time of energy conservation law, is also a obviously none exactness.

Rigid Body by Multiple Force Moment Action

A rigid body possibility is in same time, by much force moment action. These force moment may be force moment of the power, also may be the force moment of the Static force; may be differ the dimension a force arm, still may be the direction each other contrary. This is the complicated circumstance. So suffer the complicated status of many force moment action in the rigid body, should how count?

Rigid body much the count of force moment

Should count first, rigid body suffer all force moment of direction of one fold that vector sum.

$$-\tau = -\left(\tau_1 + \tau_3 + ... = F_1r_1 + F_3r_3 + ... = \sum_{i=1+2n}^{\infty} F_i.r_i\right) \tag{4.1.1}$$

$$+\tau = +\left(\tau_2 + \tau_4 + ... = F_2r_2 + F_4r_4 + ... = \sum_{i=1+2n}^{\infty} F_i.r_i\right) \tag{4.1.2}$$

Such as the formula (4.1.1) and (4.1.2), with minus sign and positive sign respectively represents the left hand turning and right hand turning of the force moment.

Then count, hinder the Static-force force moment of the rigid body rotation (for instance the force moment of the friction force). Because this Static-force force moment, also may have the direction, so the count also for minus sign and positive sign, distinguish its direction.

$$-\sigma = -\left(\sigma_1 + \sigma_3 + ... = F_{q1}r_1 + F_{q3}r_3 + ... = \sum_{i=1+2n}^{\infty} F_{qi}.r_i\right) \tag{4.1.3}$$

In formula the σ is delegate the Static-force force moment. The Static-force force moment may have the direction, and also the possibilities do not have the direction. If do not have the direction, so minus sign and the Static-force force moment of the positive sign, will be the same that.

Because the moment of force of Static-force may have the direction, also may have no the direction. So the rigid body rotation the left hand turning and right hand turning the force moment, should distinguish the computation. Namely:

$$(-\tau)+(+\tau)+(+\sigma) = \left(-\sum_{i=1+2n}^{\infty} F_i.r_i\right) + \left(\sum_{i=2+2n}^{\infty} F_i.r_i\right) + \left(\sum_{i=2+2n}^{\infty} F_{qi}.r_i\right) \tag{4.1.5}$$

$$(+\tau)+(-\tau)+(-\sigma) = \left(\sum_{i=1+2n}^{\infty} F_i.r_i\right) + \left(\sum_{i=2+2n}^{\infty} F_i.r_i\right) + \left(-\sum_{i=2+2n}^{\infty} F_{qi}.r_i\right) \tag{4.1.6}$$

Then the left hand turning moment of force subtracts the right hand turning moment of force and the moment of force of Static-force; Or is the right hand turning moment of force subtracts the left hand turning moment of force and the moment of force of Static-force. Gained the left hand turning power moment of force and right hand turning power moment of force of respectively. According to the above condition and calculate formula, then rigid body by many force moment to the rotation is may confirm, it's the angular acceleration is a left hand turning or right hand turning. Or be quiescent, or be the rotation of nothing angular acceleration.

Rigid body by much the force moment for the action result

There is the moment of force of the power, then can push the rigid body rotation. So, left hand turning and the right hand turning the total moment of force in power, namely come to a decision the rotation direction of the rigid body possibility. At this time can temporary to the moment of force of Static-force be no consider.

$$(-\tau)+(+\tau) = \left(\sum_{i=1+2n}^{\infty} F_i.r_i\right) + \left(\sum_{i=2+2n}^{\infty} F_i.r_i\right) \tag{4.2.1}$$

In the left hand turning and two total moment of forces of the right hand turning, the absolute value big subtracts the absolute value small, then regard big symbol in absolute value as the symbol. Come to a decision namely to the rigid body an actual creation acting moment of force, which is a direction in left hand turning or right hand turning.

$$\left(-\sum_{i=1+2n}^{\infty} F_i.r_i\right) + \left(\sum_{i=2+2n}^{\infty} F_i.r_i\right) \pm \tau_f \tag{4.2.2}$$

In formula the τ_f be left hand turning and right hand turning the moment of force to mutually subtract, but obtain the true moment of force. It's actual plus or minus symbol, namely the action direction that represent it. Then use it subtract the moment of force of Static-force that be as the rotation resistance:

$$\pm\tau_f \pm \sigma = (-\tau)+(+\tau) \pm \sigma \tag{4.2.3}$$

Namely total moment of force and total Static-force moment of force mutually action total outcome. In the rigid body similar to friction moment of force and Static-force moment etc, for an action

Citation: Yu G (2015) New Rotational Dynamics- Inertia-Torque Principle and the Force Moment the Character of Statics. J Appl Computat Math 4: 222. doi:10.4172/2168-9679.1000222

at obstructs to rotation. Therefore while total Static-force moment of force compare total action moment of force be big, the rigid body will keep quiescence and no rotation. When action moment of force the equal to Static-force moment of force, the rigid body will overcome the Static-force moment of force drag resistance force action, but retain rotation state. It is an even velocity rotation at this time.

Namely: $(\tau_{\mathrm{f}} < \sigma) \Rightarrow 0$ and $(\tau_{\mathrm{f}} < \sigma = 0) \Rightarrow m.R.w$ (4.2.4)

When the total moment of force exceed the moment of force of Static-force, its exceed Static-force moment of force part, become the impulse to the rigid body namely, make rigid body creation angular acceleration. At this time: $\tau_{\mathrm{f}} = \tau_d + \tau_s$ and $\tau_s - \sigma = 0$ (4.2.5)

In formula the τ_d is exceed Static-force moment of force part, the τ_s is equal to the Static-force moment of force part.

$$\tau_d + \tau_s = \left(M_R.R.\frac{dw}{dt}\right)R + (\mathrm{m.R.w}) \tag{4.2.6}$$

So, the τ d results in the angular acceleration of the rigid body. The τ s supports the rigid body overcomes Static-force the drag resistance force, but even velocity the rotation.

Force and the size of the force arm and the sequence of the computation

The left hand turn moment of force of the rigid body mutually subtract with right hand turn moment of force, big that part in moment of force, also may be multiply the moment of force. Formula (4.1.1) or (4.1.2) shows because the force makes rigid body creation angular acceleration, chiefly from the force the size decision, have nothing to do with the size of the force arm. But from positive and negative the direction counterwork in the moment of force, the force and force arm size all is relevant. So engender at this time, force and the force arm that size, which is important of actually? Which first action? Such question.

Therefore should consider first, when positive and negative the direction moment of force mutually counterwork, the decision rigid body goes which is the direction of rotation. Because of the action of the force arm is very big at this time. When the force arm is big, it can use the small force, resisting the bigger force.

Suppose: $|-\tau| > |+\tau|$ (4.3.1)

That:

$$(-\tau)+(+\tau)+(+\sigma) = \left(-\left(\overbrace{F_1r_1 + F_3r_3 + \dots + F_{1+2n-2x}r_{1+2n-2x}}^{c}\overbrace{\dots + F_{1+2n}r_{1+2n}}^{a}\right)\right) + \left(+\left(\sum_{i-2+2n}^{\infty} F_i.\mathrm{r_i}\right) + \left(\sum_{i-2+2n}^{\infty} F_{qi}.r_i\right)\right) \tag{4.3.2}$$

The size permutation of the force arm r of the formula inside moment of force is same with r subscript number size permutation the direction. So when r of subscript of the number bigger, r of the value is also bigger. Suppose in formula the vinculum a the vector quantity sum of moment of force, equal to vinculum b moment of force and the moment of force of Static-force the vector quantity sum.

That:

$$(-\tau)+(+\tau)+(+\sigma) = \left(-\left(\overbrace{F_1r_1 + F_3r_3 + \dots + F_{1+2n-2x}r_{1+2n-2x}}^{c}\right)\right) = -\tau_d \tag{4.3.3}$$

Namely left hand turn and right hand turn moment of force and the moment of force of Static-force the vectors sum, equal to inside vinculum c the moment of force the vector quantity sum. Therefore in above computation, is first by the big the arm of force in the moment of force, cancel out each other with the moment of force of Static-force and left hand turn and right hand turn. This is big because of the force arm, the force then is may small, therefore match the choice of the best the force.

Want to calculate at this time, the force makes rigid body creation angular acceleration. According to the principle of Inertia-torque, any rigid body all contain certain the parameter of Inertia-torque.

$$I_{all} = \sum m_i r_i$$

But make rigid body creation angular acceleration, according to new rigid body rotation law, the angular acceleration of the rigid body, with its rotation that tangent direction the force the size direct proportion. But have nothing to do with the force arm size of the force. Hypothesis at this time the vectors sum of the moment of force is that formula (4.3.3), so its force vector quantity sum is:

$$F_s = F_1r_1.\frac{1}{r_1} + F_3r_3.\frac{1}{r_3} + \dots = F_1 + F_3 + \dots + F_{1+2n-2x} \tag{4.3.4}$$

In the formula, via moment of force multiply the r same subscript reciprocal, coming to expunction force arm r. This process is must. Because much moment of force, must aim at the particular moment of force, after doing away with its force arm get the particular force of a correspondence. According to the new rotation law:

$$F = m.a = M_R.R.\frac{dw}{dt} \quad F_s = M_R.R\frac{dw}{dt}$$

$$\frac{F_s}{M_R.R} = \frac{dw}{dt}$$

Therefore, use the vectors sum of these force F s at this time divide with the Inertia-torque of the rigid body, then get the angular acceleration of the rigid body. So to the computation of many force moment of the rigid body, it is achieve all.

In formula (4.3.4), each the moment of force for that throws off the correspondence the arm of force, to get the actual force. This is very important. When the rigid body only have positive and negative directions the moment of force by the action, the may also require to calculated like this.

For example: $|-\tau| > |+\tau|$ so $(-\tau)+(+\tau) = -\mathrm{F_a r_a} + F_b r_b = -F_x r_a$ (4.3.6)

Throw off the force arm $\mathrm{r_a}$: $-F_x r_a.\frac{1}{r_a} = -F_x = -M_r.r_a.\frac{dw}{dt}$ (4.3.7)

Two the vector quantity sum of moment of force, get new moment of force, it's the arm of force with big the vector quantity the module the force arm of moment of force same. Namely $\mathrm{r_a}$ in the formula. Throw away that parameter, then get the acting force, and become the angular impulse to the rigid body.

$$P_x = -\int F_x dt = -\int \left(M_r.r_a.\frac{dw}{dt}\right)dt \tag{4.3.8}$$

Above of the discuss indicate, when many force moment is action at the same time in a rigid body, from mechanics and physics regulation the decision. First these moment of forces, will automatically with the moment of force in big arm of force, come the compare and antagonize. Toing decide rigid body is stillness or a rotation, and their rotations which is directions. Afterward from the smaller the arm of force that moment of forces of that part the all the sum of the force, come to become the impulse to the rigid body. Make rigid body creation angular acceleration. Therefore, the rotation of the rigid body whether and to one direction creation angular acceleration, was two differ process. Have got the patency the change in front and back.

The Angular Momentum Conservation of the Rotation Object and that is Not Conservation

When the object do the circular motion is the angular momentum

Citation: Yu G (2015) New Rotational Dynamics- Inertia-Torque Principle and the Force Moment the Character of Statics. J Appl Computat Math 4: 222. doi:10.4172/2168-9679.1000222

conservation, below will study angular momentum conservation or that is not conservations of the slewing rigid body.

Angular momentum conservation of the particle circular motion

Angular momentum in the classical mechanics is conservation, is because the particle or the objects the circular motion, when the rotation radius R change, the centripetal force makes the velocity between the particle or the object, occurrence and the change of the radius R inverse proportion. Such as the Figures 5 and 6 the show.

Is two kinds circumstances of the radius R from big diminish and from small become the big. From the figure inside to look, the centripetal force make the object produce a movement quantity to the center of a circle direction, it to plus with the change previous the object linear velocity the vector quantity, then obtain a new line velocity of the object. Inside the figure of the velocity vector quantity u_1 u_2 and slewing radius r_1 r_2, and centripetal kinetic vector quantity in the object, constituted some right triangle, and these triangles all are similar triangles. Thereupon these vector conform the composition of the vector quantity and the relation of the decomposition. But vector quantity u_1 u_2 and radius r_1 r_2 constitute two right triangles, is similar triangles. Also explain it will have relation as follows. Namely:

$$\frac{r_1}{r_2} = \frac{u_2}{u_1} \tag{5.1.1}$$

So at change front and back, the velocity vector quantity and slewing radius is change with inverse proportion. Thereupon in above process, without change the angular momentum of the object.

$$l = m.r_1.u_1 = m.r_2.u_2 \tag{5.1.2}$$

Formula (5.1.1) and (5.1.2) versus Figures 5 and 6 all usable similarly.

Come see is not difficult, Figures 5 and 6 the show, when the radius occurrence changes of the circular motion in object or particle, it's the movement linear velocity will change with inverse proportion. This kind's circumstance is from the principle decision of decomposition (Figure 6) and resultant (Figure 5) of the vector quantity, thereupon is a kind movement concerning matter and the natural select of the principle of the force. It is inevitable, any object or particle at do circular motion the time, all follow this regulation. Namely its slewing radius and velocity vector is change with inverse proportion.

When the change of the radius R of the circular motion of the object, it's in blink the realization, then can adopt differential the algorithm at this time.

$$l = m.\left(r \pm \frac{dr}{dt}.dt\right).\left(u \pm \frac{du}{dt}.dt\right) = m.(\mathrm{r} \pm \mathrm{dr}).(\mathrm{u} \pm \mathrm{du}) \tag{5.1.3}$$

$$\frac{r}{(\mathrm{r} \pm \mathrm{dr})} = \frac{(\mathrm{u} \pm \mathrm{du})}{u} \tag{5.1.4}$$

At this time obviously:

So the change in R is in early or late, the object still keep the angular momentum is invariability, namely angular momentum conservation.

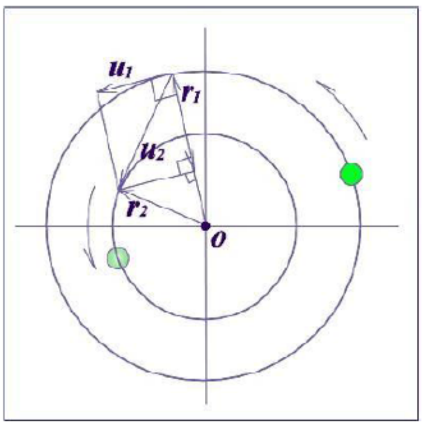

Figure 5: The R from big change to small.

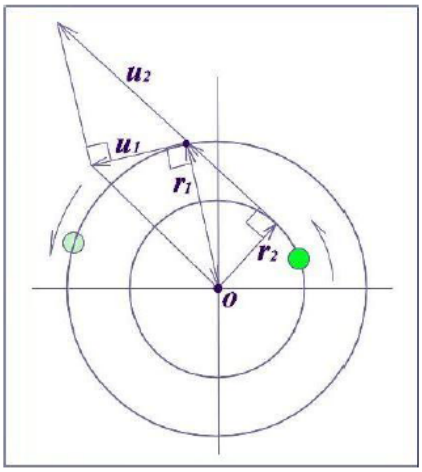

Figure 6: The R from small change to big.

The circular motion between object or particle the possess angular momentum conservation, the best the patency instance in this kinds circumstance, namely inside universe every kind of celestial bodies running. Moreover, this kind of circumstance is applicable to only, object or particle suffers the centripetal force acting circumstance only. If differ the object is in circular motion, the interaction of the similar collision in occurrence. Then because of new object interaction law [5] Differ the object of the mass when the interaction, the interaction force is different. So the collision is in early or late, the angular momentum of these objects and the angular momentum the sum, will is change the occurrence. Therefore at this time, the angular momentum between object or particle, will be what is not conservation.

The angular momentum conservation of the rigid body

Because the principle of Inertia torque of the rigid body, in rigid body the angular momentum change is a complicated process. Such as the Figure 7 show:

Suppose that rigid body be constituted by particle m_1 m_2 m_3 m_4. They the rotation of with the angular velocity ω_1 of circled the origin o. Among them the rotation radius of the particle m_1 is the r_1, the particle m_2 m_3 m_4 the rotation radius is the r_2. The total angular momentum of the system is of at this time:

$$L = m_1.r_1^2.w_1 + m_2.r_2^2.w_1 + m_3.r_2^2.w_1 + m_4.r_2^2.w_1 \tag{5.2.1}$$

If the particle m 1 go to motion of the center of a circle direction, arrive its rotation radius equal to r_2. Because saying in front, the object the angular momentum conservation. The particle m_1 be inclined to the new angular velocity in engender, namely:

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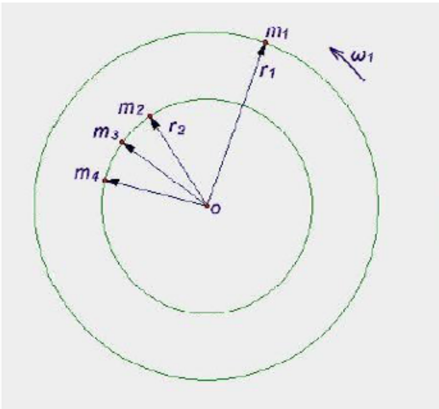

Figure 7: the rigid body of angular momentum conservations.

$$(l_1 = m_1 . r_1^2 . w_1) \Leftrightarrow \left(l_1 = m_1 r_2^2 . (\frac{r_1}{r_2})^2 w_1 \right) \tag{5.2.2}$$

Because of the constraint of the rigid body, the particle m_1 m_2 m_3 m_4 should always have the same angular velocity. Therefore at this time, from the m_1 the angular velocity for inclining to change will make particle m_1 and m_2 m_3 m_4 to an action the force.

$$F_{all} = F_1 + F_2 \tag{5.2.3}$$

Inside the formula the F_1 is particle m_1 do suffered, tendency the force that obstructs its angular velocity change. The F_2 is the particle m_2 m_3 m_4 do suffered, tendency the force of the angular velocity in enlargement. Two directions of force is contrary, F_2 direction and original angular velocity in rigid body the ω_1 is same, the F_1 then is contrary with it. Because two objects act mutually, the size magnitude of the force and two objects mass geometric proportion [5]. So:

$$\frac{F_1}{F_2} = \frac{m_2 + m_3 + m_4}{m_1} \tag{5.2.4}$$

$$F_1 . t = m_1 r_2 w_2 \tag{5.2.5}$$

$$F_2 . t = (m_2 + m_3 + m_4) r_2 w_3 \tag{5.2.6}$$

The ω_2 is when a particle m_1 do move to the rotation radius r_2, for to no can enlarging that angular velocity. The ω_3 is particle m_2 m_3 m_4 an angular velocity for enlarging. Therefore:

$$w_2 + w_3 = \left(\frac{r_1}{r_2} \right) w_1 - w_2 \tag{5.2.7}$$

In Figure 7 is circumstance that $r_1 > r_2$, if is a $r_1 < r_2$ that circumstance, the ω_2 in the formula (5.2.5) is a particle m_1 to travel the rotation radius r_2, that an angular velocity for no can minish. But ω_3 in the formula (5.2.6) is then particle m_2 m_3 m_4 an angular velocity for minish. The formula (5.2.7) also will become at this time:

$$w_2 + w_3 = w_1 - \left(\frac{r_1}{r_2} \right)^2 w_2 \tag{5.2.8}$$

Therefore, be to have a particle or an object on the rotation rigid body, take place radial the move. It will make the angular velocity occurrence change of the rigid body. And, this is as if angular momentum conservation the change. Namely the object if travel toward center of a circle direction, the angular velocity enlarge; Whereas the angular velocity minish.

In rotation rigid body the mass mapping and composition mass

The Inertia-torque of the rotation rigid body, its correspondence in the mass of burthen of any force arm, is the quantity that is certain. Usually it is that a quantity of composition, in it inside have true particle the mass, also have from other the force arm the particle, the mass mapping of mapping. Also include the true mass, also include the mass mapping, this circumstance is the mass composition.

$$A = \{m_x, r, w\} B = \{m_m, r, w\} \quad C = \{m_x, m_m, m_c, r, w \mid m_c . r, r \times (m_c . r . w)\} \tag{5.3.1}$$

$$A \subseteq C \quad B \subseteq C \quad f : A \to B \quad g : B \to C \ h : A \to C gof : A \to C \tag{5.3.2}$$

$$A = \{m, r, w\} A \cap A = \{r, w\} \quad A \cap B = \{r, w\} \ A \cap C = \{r, w\} \tag{5.3.3}$$

The above formula the m and m x is true mass, the m is the mass mapping, the m c is the mass composition. Express the mass composition can represent the true and mapping all the mass, control the rotation of the rigid body, and to calculate the rigid body rotation movement. Among them collection A, B, C representative rotation rigid body not the radial move the part, but collection A is on the rotation rigid body, taking place the radial move the part of the object.

Inside rotation rigid body for the object to radial move the angular velocity change and the mass the relation

When the object or particle radial moves on the rotation rigid body, it induces angular velocity change of the similar angular momentum conservation. Its angular velocity changes with differ partial of the rigid body, is having some relation in the mass. Be got by formula (5.2.4) (5.2.5) (5.2.6):

$$\frac{F_1}{F_2} = \frac{F_1 . t}{F_2 . t} = \frac{m_1 r_2 w_2}{(m_2 + m_3 + m_4) r_2 w_3} = \frac{m_2 + m_3 + m_4}{m_1} \tag{5.4.1}$$

$$\frac{w_2}{w_3} = \frac{(m_2 + m_3 + m_4)(m_2 + m_3 + m_4) r_2}{m_1 m_1 r_2} = \frac{(m_2 + m_3 + m_4)^2}{m_1^2} \tag{5.4.2}$$

And

So, move the object for without can changing an angular velocity ω_2, with the angular velocity ω 3 of rigid body the rest of occurrence change of two angular velocities it ratio; equal to the square of rigid body the rest of masses, with move the object mass square these two mass square it the ratio. Therefore, when the object occurrence radial on the rotation rigid bodies the move their angular velocity occurrences change. The size of its angular velocity change, with the mass of the rigid body and the mass of the move object, the like formula (5.4.2) to confirm the relation.

Certainly, the above computation is a rigid body to be limited by only such as the Figure 7 show, only have particle m_1 m_2 m_3 m_4 four particles a very simple system for constituting. Under the majority circumstance, the structure of the rigid body is impossible to be so simple. Therefore can is divided into the rigid body at this time, Taking place the radial move the collection A the part, and that has no arises the radial move that the part the collection C. Is shown as formula (5.3.1) and (5.3.3), the collection A representation the object of move, there into ternate element the product be used as an element, by it is a unit element collection. The collection C representative the rotation rigid body, it is a finite collection, among them the element m c and r to opposite in each other, their product is this rigid body (do not include move on this rigid body the object) the Inertia-torque namely. The formula (5.4.2) will become at this time:

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$$\frac{w_2}{w_3}=\frac{m_c m_c r_2}{m m r_2}=\frac{m_c^2}{m^2} \tag{5.4.3}$$

Here because the token m 1 of the mass m of the object of radial movement to at this time, and that use to the rigid body the radius r_2 the composition mass m_c , represent m_2 m_3 m_4 three particle the mass. At this time m c is yet the rigid body radius r_2 physical tangential direction load mass. Thereupon it possibility include the true particle mass, also may include this radius to other part rigid body the mass mapping. The expression of the recombination mass m_c is:

$$m_c=\frac{I_c}{r_2} \tag{5.4.4}$$

In formula the I_C is Inertia-torque by collection C.

The recombination mass of the rigid body can represent the truth and all mass of the mapping, come to slewing that constrain the rigid body, and realization the rigid body slewing movement reckon. So can by recombination at this time the mass m_c to represent m_2 m_3 m_4 three masses of particle, go along reckon such as formula (5.4.2), thus gained formula (5.4.3). The principle is alike, expressing such mass of the rigid body the relation, deciding the relation of its angular velocity change.

Thereupon by slewing on rigid body to the mass of the object of radial movement of occurrence, and rigid body other part is in that move object in it arrive the radius the burthen mass, then get the ω_2 and ω_3 of ratio. Pass again the formula (5.2.7) and (5.2.8) the transform, can get the physical angular velocity change value of the rigid body again:

$$w_3=\left(\frac{r_1}{r_2}\right)^2 w_1-w_1-w_2 \tag{5.4.5}$$

$$w_3=w_1-\left(\frac{r_1}{r_2}\right)^2 w_1-w_2 \tag{5.4.6}$$

ω_3 is an angular velocity change that rigid body occur fact.

The compute of the slewing rigid body angular velocity change

According to above of analysis (5.2.2), was to know the mass m of the object in move in slewing rigid body, and it the fore-and-aft the radius r_1 and r_2, can namely obtain it because the angular momenta conservation, but the value of the angular velocity that occurrence change:

$$\left(\frac{r_1}{r_2}\right)^2 w_1=\frac{l_A}{m.r_2^2} \tag{5.5.1}$$

The actual angular velocity change ω 3 that after whole rigid body will occur, with r_1 and r_2 , and ω_1 and ω_2 the relation, be meant by formula (5.4.5) and (5.4.6).

Be got by formula (5.4.3):

$$w_2=\frac{m_c^2}{m^2}.w_3 \tag{5.5.2}$$

Get this formula joined (5.4.5) and (5.4.6):

$$w_3=\left(\frac{r_1}{r_2}\right)^2 w_1-w_1-\frac{m_c^2}{m^2}.w_3 \tag{5.5.3}$$

$$w_3=w_1\left(\frac{r_1}{r_2}\right)^2 w_1-\frac{m_c^2}{m^2}.w_3 \tag{5.5.4}$$

Transform expression:

$$w_3+\frac{m_c^2}{m^2}.w_3\left(\frac{r_1}{r_2}\right)^2 w_1-w_1 \tag{5.5.5}$$

$$w_3+\frac{m_c^2}{m^2}.w_3=w_1-\left(\frac{r_1}{r_2}\right)^2 w_1 \tag{5.5.6}$$

$$\text{Till: } w_3=\left(\frac{r_1^2}{r_2^2}-1\right)w_1\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.7}$$

$$\text{And } w_3=\left(1-\frac{r_1^2}{r_2^2}\right)w_1\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.8}$$

It is that ω_3 with ω_1 and r_1 and r_2 and m and m_c the algebras relation. As long as controlled above r_1 and r_2 and m and m_c each parameter, the substitution formula progress calculates, namely getting the value ω_3 of the change of the angular velocity that rigid body will take place then.

Therefore, formula (5.5.7) and (5.5.8), namely is the formula to compute the rigid body angular velocity change. The anterior is circumstance that $r_1 > r_2$, the posterior is circumstance $r_1 < r_2$. Below:

$$w_3=w_1\left(d\left(\frac{r_1^2}{r_2^2}\right)-1\right)\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.9}$$

$$w_3=w_1\left(1-d\left(\frac{r_1^2}{r_2^2}\right)\right)\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.10}$$

And

This is the object that radial move to least that differential computation formula. When the object prosecution in the rigid body a line of consecutive radial move, that change of the rigid body angular velocity, it is applied the definite integral to calculate:

$$w_3=\int_{r_1}^{r_n} f(w,r)\left(d\left(\frac{r_1^2}{r_2^2}\right)-1\right)\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.11}$$

$$w_3=\int_{r_1}^{r_n} f(w,r)\left(1-d\left(\frac{r_1^2}{r_2^2}\right)\right)\Big/\left(1+\frac{m_c^2}{m^2}\right) \tag{5.5.12}$$

And

The r_1 is the radius to travel the first in object; r_n is it does arrive finally the radius. The m_c^2 in the formula although is also a variable, but it is that dependent variable of radius r_2. So, in computation merely with the variable "r" relevant parameters progress differential. In addition according to formula (5.5.7) and (5.5.8):

$w_1=f(\mathrm{w,r})$ (5.5.13)

Therefore via to the continuous computation of the definite integral (5.5.11) and (5.5.12) get the last accurate result namely.

Beg the approximate value to the integral of the formula (5.5.11) and (5.5.12), get:

$$\begin{aligned}&\int_{r_1}^{r_n} f(\mathrm{w,r})\left(d\left(\frac{r_1^2}{r_2^2}\right)-1\right)\Big/\left(1+\frac{m_c^2}{m^2}\right)\approx w_1.\left(\left(\left(\frac{r_1^2}{r_2^2}-1\right)\Big/\left(1+\frac{I_c^2}{r_2^2 m^2}\right)+1\right)\right.\\&\left.\cdot\left(\left(\left(\frac{r_1^2}{r_3^2}-1\right)\Big/\left(1+\frac{I_c^2}{r_3^2 m^2}\right)+1\right)\ldots\left(\left(\left(\frac{r_{n-1}^2}{r_n^2}-1\right)\Big/\left(1+\frac{I_c^2}{r_2^2 m^2}\right)+1\right)\right)\right.\end{aligned} \tag{5.5.14}$$

$$\begin{aligned}&\int_{r_1}^{r_n} f(\mathrm{w,r})\left(1-d\left(\frac{r_1^2}{r_2^2}\right)\right)\Big/\left(1+\frac{m_c^2}{m^2}\right)\approx w_1.\left(\left(\left(\frac{r_1^2}{r_2^2}-1\right)\Big/\left(1+\frac{I_c^2}{r_2^2 m^2}\right)+1\right)\right.\\&\left.\cdot\left(\left(\left(\frac{r_1^2}{r_3^2}-1\right)\Big/\left(1+\frac{I_c^2}{r_3^2 m^2}\right)+1\right)\ldots\left(\left(\left(1-\frac{r_{n-1}^2}{r_n^2}\right)\Big/\left(1+\frac{I_c^2}{r_2^2 m^2}\right)+1\right)\right)\right.\end{aligned} \tag{5.5.15}$$

If the objects on the rotation rigid body that radial move, is a freedom and constraint not from r_1 to r_2 in the interval. After simply arrived r_2, just again act with rigid body mutually, make collection C with collection A by together connect again. Therefore its angular velocity will constraint because of each other it to the assimilate. At this time the computation of the angular velocity change concerning this rigid body, be by formula (5.5.7) and (5.5.8), come to actualize in briefness. Therefore formula (5.5.7) to (5.5.12) can actualize the complete computation that the angular velocity of the rotation rigid body changes.

The change of the rotation rigid body angular momentum and changeless?

When that objects collection A', on collection C those rotations rigid body to radial move, that object collection A and collection C that rotation rigid body, they total angular momentum do can change? This point will decide to be below this circumstances, this rotation's rigid body whether angular momentum conservation?

Arbitrarily the total Inertia-torque of the rigid body is:

$$I_{all} = m_1 r_1 + m_2 r_2 + ... + m_n r_n = \sum m_i r_i$$

In textual subject suppose this I all is a total Inertia-torque in collection C the rigid body. Arbitrarily the total angular momentum of the rigid body is:

$$L_{all} = m_1.r_1^2.w + m_2.r_2^2.w + ... + m_n.r_n^2.w = (\mathrm{x})\,\mathrm{mr}^2\, w$$

In textual subject too suppose this L all is collection C the first total angular momentum in the rigid body, among them the ω is namely the ω_1.

On that collection C rotation rigid body of behind radial move of collection A object, between the collection A object and collection C rotation rigid body, will engender the interaction force.

$$F_1 = mr_2 \frac{dw_2}{dt} \tag{5.6.1}$$

$$F_2 = m_c r_2 \frac{dw_2}{dt} \tag{5.6.2}$$

The F 1 is a force to collection A the object suffers, the F_2 is collection C the rotation rigid body, in the mass composition is m c and radius is r_2 suffer a force.

In fact F_1 form an angular impulse on collection A object:

$$F_1.r_2.t = m.r_2^2.w_2 \tag{5.6.3}$$

Therefore it makes collection A object occurrence angular momentum change.

Same reason, F_2 likewise versus collection C the rotation rigid body engender an angular impulse:

$$F_{\,2}.r_2.t = m_c.r_2^2.w_3 \tag{5.6.4}$$

It also makes collection C rotation rigid body occurrence angular momentum change. Discover is not difficult the force F1 is a direction with force F2 contrary, therefore their angular impulse is also a direction contrary. So collection A the object and collection C the rigid body, the angular momentum change of the occurrence, also the direction is contrary. Both the module of the vector subtracts mutually, also will become to collection A the object and collection C the rigid body, total angular momentum change.

On a rigid body for with angular velocity ω_1 rotation, on the angular velocity of the all particle, is all a ω_1 also. Therefore, the angular velocity of the rigid body is with its angular momentum direct proportion. Therefore a rigid body, it's the particle the m and r invariability, but the change multiple of the angular velocity, namely with the change multiple of its angular momentum is sameness. In anterior analyses, first angular velocity in rigid body is ω1, the object collection A' behind move, the angular velocity that collection C rigid body will change the ω 3 . So at this time collection C rigid body angular momentum change rate is:

$$\frac{L_{change}}{L_{all}} = \frac{w_3}{w_1} \tag{5.6.5}$$

In formula the L_{all} is collection C earliest angular momentum, the L change is collection C mutative angular momentum, ω_3 is mutative angular velocity.

But towards the collection A, the object moves, if it change ω_2 plus ω_3 the angular velocity, its angular momentum invariability. But because it with interaction that collection C the rigid body, it have the ω_2 of the angular velocity did not can change. So at this time collection A the angular momentum cannot change the ratio is:

$$\frac{l_{change}}{l_A} = \frac{w_2}{w_1 - w_2 - w_3} \tag{5.6.7}$$

In formula the l_A is first angular momentum of the object of collection A, the l_{change} is mutative angular momentum behind object move. It is not difficult to comprehension is that so called, the collection A the object angular momentum could not change that ratio, in reality is the change rate of its angular momentum, but is minus and direction is anti.

The collection A object and the collection C rigid body total the angular momentum, behind the object collection A move, whether occurrence change? Obviously as long as see to collection A the object and collection C the rigid body the angular momentum change, whether exactly is size equivalency and direction is contrary. Beyond all doubt, two changes of angular momentum, the direction contrary is affirmative. But whether is a size equals that need to the proof. Is shown as formula below:

$$\frac{w_3}{w_1}.L_{all} = \frac{\omega_2}{\omega_1 + \omega_2 + \omega_3}.l_A \tag{5.6.8}$$

$$\frac{w_3}{w_1}.L_{all} = \frac{\omega_2}{\omega_1 - \omega_2 - \omega_3}.l_A \tag{5.6.9}$$

Be got by formula (5.2.7) and (5.2.8) (regardless is circumstance that $r_1 > r_2$ or $r_1 < r_2$):

$$\frac{L_{all}}{l_A} = \frac{\omega_1.\omega_2}{\omega_3 \cdot \left(\dfrac{r_1^2}{r_2^2}\right).\omega_1} \tag{5.6.11}$$

$$\frac{L_{all}}{l_A} = \frac{\omega_2.r_2^2}{\omega_3.r_1^2} \tag{5.6.12}$$

According the formula (5.4.3), the equality changes into again:

$$\frac{L_{all}}{l_A} = \frac{m_c^2.r_2^2}{m^2.r_1^2} \tag{5.6.13}$$

According to an idea can changes for again:

Citation: Yu G (2015) New Rotational Dynamics- Inertia-Torque Principle and the Force Moment the Character of Statics. J Appl Computat Math 4: 222. doi:10.4172/2168-9679.1000222

$$\frac{m_1.r_1^2.\omega + m_2.r_2^2.w + ... + m_n.r_n^2.\omega}{m.r_1^2.\omega_1} = \frac{m_c^2.r_2^2}{m^2.r_1^2} \quad (5.6.14)$$

The equal sign the left side the numerator partial that coefficient ω namely ω 1 so can reduction of fraction.

$$\frac{m_1.r_1^2 + m_2.r_2^2 + ... + m_n.r_n^2}{m.r_1^2} = \frac{m_c^2.r_2^2}{m^2.r_1^2} \quad (5.6.15)$$

Further transform:

$$(\mathrm{m}_1.\mathrm{r}_1^2 + \mathrm{m}2.\mathrm{r}_2^2 + ... + \mathrm{mn}.\mathrm{r}_n^2).\mathrm{m} = \mathrm{m}_c^2.r_2^2 \quad (5.6.16)$$

Be got by formula (5.4.4):

$$(\mathrm{m}_1.\mathrm{r}_1^2 + \mathrm{m}2.\mathrm{r}_2^2 + ... + \mathrm{mn}.\mathrm{r}_n^2).\mathrm{m} = \mathrm{m}_c^2.r_2^2 = \frac{I_c^2}{r_2^2} \quad (5.6.17)$$

$$m = \frac{(\mathrm{m}_1\mathrm{r}_1 + \mathrm{m}_2\mathrm{r}_2 + ... + \mathrm{m}_\mathrm{n}\mathrm{r}_\mathrm{n})^2}{(\mathrm{m}_1.r_1^2 + \mathrm{m}_2\mathrm{r}_2^2 + ... + \mathrm{m}_\mathrm{n}.\mathrm{r}_n^2)} \quad (5.6.18)$$

Or $$\frac{}{L_{all} \quad w} \quad (5.6.19)$$

On these grounds, the conclusion is patency. The formula (5.6.8) and (5.6.9) is not the identical equation, while satisfy formula (5.6.18) and (5.6.19) they just tenable. At this time in the equal sign both sides, the obviously possessive quantity is all constant. The right side of the for instance equal sign, inevitable is a positive the rational number. When the condition ascertain, is only its the value. Thereupon if want the equality tenable, the representative of the left side of the equal sign the collection A the move the object the mass m, also musting be single affirmatory the value, is equal to the equal sign the value of the right side.

Formulas (5.6.18) and (5.6.19) display very interesting, a kind the attribute of the slewing rigid body. It expresses, when the slewing rigid body, have the object by the radial move, the said rigid body can not necessarily keeps angular momenta conservation. At this time in that rigid body, the move object of collection A and the slewing rigid body of collection C, must be to satisfy the formula (5.6.18) and (5.6.19), is just under the circumstances, can satisfy the angular momenta conservation. Not so its angular momenta are not conservation. Therefore this formula similar is a law to that rigid body angular momentum whether conservation, count for much.

If the equal sign both sides near to the equivalency, then it can look like to satisfy the angular momenta conservation. But if equal sign the left side larger than to in equal sign the right side, namely collection A move the object the mass m larger than certain value, then collection A move object angular momenta change, for the smaller than the collection C slewing rigid body angular momenta change. Contrarily collection "A" moves the object angular momenta change, larger than to collection C slewing rigid body angular momenta change. Will is conducing the total angular momenta occurrence change of slewing system, thereupon angular momenta is not conservation.

Thereupon, be there is object on the slewing rigid body along the radial move, its total angular momenta can keep the invariable condition is very rigour. So under this kind of circumstance of the plurality, the slewing rigid body is all angular momenta is not conservation.

The slewing rigid body is under most circumstances is not conservation the angular momenta

Thereupon when the slewing rigid body, have the object to the radial move, its angular momenta is all usually is not conservation.

But because Newton third law, have been by testify be a wrong [5] , and from new object interaction law, two object interaction operations, the dimension of force and the mass of two object is geometric proportion [5]. Therefore the object linearity momentum conservation law also is wrong.

And momentum conservation law since is wrong, so in a matter system, have no the operation of the external force even, from inside of system the object of interaction, also can work system momenta a change. This kind the circumstance is too be applicable, in slewing the matter system the slewing linearity momenta. Therefore linearity momenta of slewing object, it is not conservation also.

So, in a slewing rigid body system, has no the operation of the external force moment even, be moved by object in the system radial, or the object by operation in the slewing positive and negative orientation, all can conduce the angular momenta in rigid body to change. The angular momenta of the for this reason slewing rigid body is all under most circumstances is not conservation.

The slewing of the concerning object, besides satisfying the formula (5.6.18) and (5.6.19), still reserve the angular momenta conservation, is an object or particle encircle the circular motion, but it's in addition to only having the radial movement(namely change slewing radius), without any direction of a tangent force(is an internal force or an external force regardless) operation. As long as satisfied the kind condition, then it is angular momenta conservation in hold. For instance celestial body in the cosmos, encircle the slewing of the fixed star, namely usually has this kinds of angular momenta conservation.

Lever and Moment of Force Principle the New Challenge

According to the Inertia-torque principle, the force arm of the moment of force the change toing the transform is the mass of burthen of the rotation is not force. So engender in the ancient Greece era the lever principle, and in classical mechanics the rotation law of rigid body, will suffer the challenge apparently.

When use the lever unclench heavy object, it just changed in fact the mass of burthen of the force arm, but not changes the force? Because the rotation law of the classical mechanics is wrong, that modern machinery by extensive use, the gear and pulley transmission equip, in fact too is not laborsaving? Is such? This point is in fact also not absoluteness.

Lever and moment of force the laborsaving, in the statics the levels, such as positive and negative direction the moment of force that antagonize, is what really exist. There is an object for example, it resist the locomotion with the very big force (may be the Static force). So for overcoming this force, but make this object the locomotion, for needing the force is what differs very much.

$$|-\mathrm{F}\,| \geq |+\mathrm{F}\ 2| \text{ or } [\mathrm{F} = (\mathrm{m.a})] \geq [\mathrm{F}_\mathrm{q} = \mathrm{i.(m.a)}] \quad (6.0.1)$$

no lever or moment of force, require is than this force the larger force, then can to action and make it locomotion.

$$[\frac{F_1}{p}.(\mathrm{p.r})] \geq [\mathrm{F}_2.\mathrm{r}] \quad (6.0.2)$$

Contrarily:

$$[\frac{F}{p}.(\mathrm{p.r})] \geq [\mathrm{F}_2.\mathrm{r} = \mathrm{i.(m.a).r}] \quad (6.0.3)$$

via lever or moment of forces, merely require is than the slightly big force in inverse proportion in arm of force it is may. Pass lever or moment of forces namely, use the small force can resist the bigger force, to the object do action or make object moved.

Certainly, in the inertial state, to make same angular acceleration in acquisition in rigid body, the force at arbitrarily force arm is all a same big.

$$F = m.a = M_R.R.\frac{d\omega}{dt} = \frac{M_R}{p}.(\mathrm{p.R}).\frac{dw}{dt} \tag{6.0.4}$$

Therefore, this is ambivalent. If make the engine of the machine, drive the machinery to inertial of locomotion. Namely changes the state of running of the machinery, make it have the variable motion, then at this time of machinery in reality is do not save labour. For example at use the crane lift heavy object, apace the enlargement raises the velocity.

But, if make the running of the machinery; keep at the state of durative no acceleration. Therefore it is an equilibrium state in Static-force. At this time the thrust of the engine, then according to lever and the principle of the moment of force, may be laborsaving or is hard sledding.

$$\left(\frac{F_{q1}}{p} p(\mathrm{r.s}) = \frac{(\mathrm{i.m.}\frac{d^2 l}{dt^2})}{p} .p(\mathrm{r.S}) \right) = F_{q2}.r.S \tag{6.0.5}$$

This kind of circumstance is the Static-force do the work. When the Static-force does the work, it is primarily to overcome the Static-force the resistance forces for instance friction, gravity, etc. When the crane lift the heavy object, keep low speed and uniform motion, it is can use the small force of sustain, lift the monstrous and heavy object. Make become impossible to the possible; this is still the valid application of ancient the lever principle.

Thereupon, the lever principle did not for Inertia-torque principle but lose its meaning all. It still has the value in the statics level.

Summing-up

Textual show Inertia torque principle, the rigid body rotation law of the classical mechanics of verification is wrong, and adduces new rigid body rotation law of principle of the Inertia-torque. Textual attest, the rotation of the rigid body, have the multiply slewing kinetic energy. Is rotation radius bigger in a rigid body, also its slewing kinetic energy is bigger? Thereby slewing rigid body, the facto is not conservation the energy. Textual also attest, rigid body by much force moment the action, the force moment versus decide its rotation direction have more larger operation, but the force is to its the impulse of the rotation have more larger operation. Two kind circumstances is contain hypostatic differ. Textual put forward the concept of the new angular momentum in variety of the rigid body, pointing out encircle the circular motion the object the angular momentum conservation the reason, and the rigid body the angular momentum change and compute, and the rigid body is under most circumstances that angular momentum is not conservation. Textual new discovery is an ancient lever principle, without totally wrong. The status in the uniform motion, the lever save labour principle, still can is the durative actualize. Thereupon pass the textual reasoning, concerning lever and force moment, concerning rigid body rotation, have a whole set the new cognition new principle and its characteristics and quiddity.

It have no the mass mapping and burthen mass that concept in the classical mechanics to the rotation rigid body, from the classical rotational dynamics the moment of inertia in rigid body, can deduce the mass of burthen of the rigid body rotation, with it is radius square inverse proportion relation. From this also can deduce force moment principle, rigid body rotation law and angular momentum conservation, all the classical rotational dynamics principle. But the concept of the moment of inertia of the rigid body is wrong, so the classical rotation dynamics theory system of whole, overflow with several of mistake. For this reason classical rotational dynamics, must proceed important the regulation and modification.

Acknowledgment

The authors to thank the Editorial Office. The authors to thank references author.

The authors to thank his teachers are for his technology activity by gave auspice:

Professor Shixu Guan, Chief editor Xinmin Zhu, Principal Lanxu Xu.

The authors thank do ever assisted his the university:

Department head Shuquan Wang, Department head Xinde Jiang, Associate Professor Risheng Piao.

And many teachers.

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