NEW ROTATIONAL DYNAMICS

—— Inertia-torque principle and the force moment the character of statics

GuagSan Yu
(Harbin · Macro · Dynamics Institute. 150066, P. R. China)
E-mail:sxzyu35@hotmail.com

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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.

Key Words: Rigid body; Inertia-torque; Centroid-moment; Centroid-arm; Statics; Static-force; Dynamics; Conservation law

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0 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 is: 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[1,2].

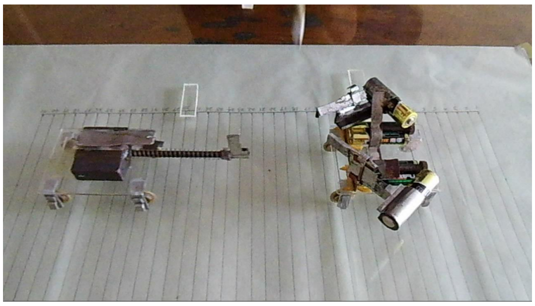

Figure 1 experiment testify momentum is not conservation

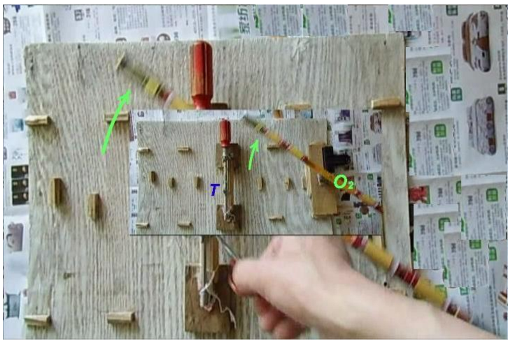

Figure 2 The experiment of physics of mechanics of the Inertia-torque

Figure 1 and Figure 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 be from figure 2 and figure 1 the experiment generates. Therefore textual argumentation is haved the experiment the evidence and sustaining, don't is simple reasoning or hypothesis or conjectures.

1 The notion the Inertia-torque

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

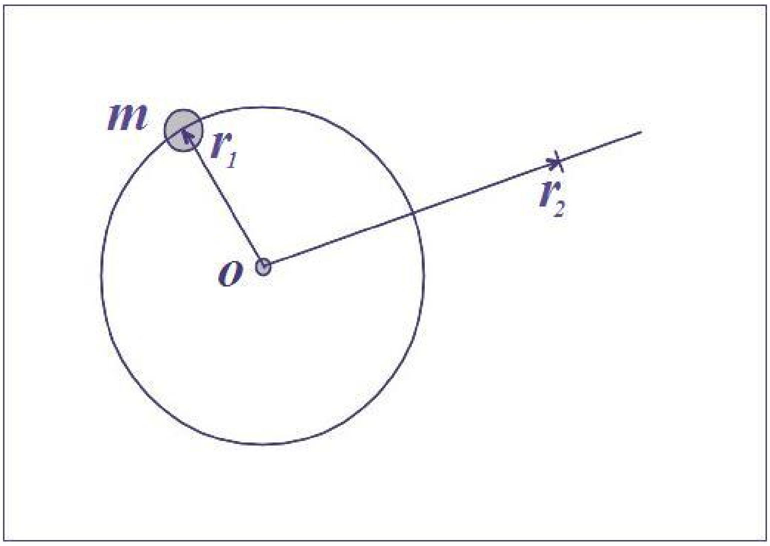

Figure 3 concerning inertia-torque

Why can save labour it the lever? The moment of force really do to force the change? Do it nope to the object burthen the mass occurrence change? The Inertia-torque, namely, such as figure 3 the show, the particle ***m*** (***m*** also is its mass) is a $\boldsymbol{r_1}$ to ***O*** the position vector, so it the Inertia-torque is:

$$I = m \cdot r_1 \qquad (1.0.1)$$

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 $\boldsymbol{r_2}$ in graph, namely must proceed the change.

If $r_2 = qr_1$ well then $I = m \cdot r_1 = \frac{m}{q} \cdot r_2$ (1.0.2)

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

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

Such as the correspondence in Inertia-torque: $I = m \cdot r_1$.

Its direction of tangent line the mass, namely: $m = \frac{I}{r_1}$ (1.0.3)

But the correspondence in the $\boldsymbol{r_2}$ of the formula (1.0.2), the direction of tangent line the mass:

$$m_2 = m \cdot \frac{1}{q} = \frac{I}{r_2} \qquad (1.0.4)$$

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 the tangential mass, are all may be true mass, or is not true mass the mapping mass.

The mapping mass and true mass, the quality is different. True mass embodiment the object true exist, so it is in object, having the actual influence to the object the inertia. But mapping mass, it oneself is not really the esse. It merely be 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.

1.1 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.

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. Its different, is two revolution arm it one is in 1/2 arm the push, and one is in all arm the push.

The result 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 firsthand and dependable sustain.

$$F_1 = m_1 a_1 = m \cdot \frac{R\theta}{t^2} = m \cdot R\beta \tag{1.1.1}$$

$$F_2 = m_2 a_2 = \frac{m}{2} \cdot \frac{2R\theta}{t^2} = \frac{m}{2} \cdot 2R\beta \tag{1.1.2}$$

Inside the formula, the $\boldsymbol{\theta}$ is central angle turned by revolutions arm, the $\boldsymbol{\beta}$ is an angular acceleration. Therefore two experiment, the impulse force of the spring is 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 explain the experiment and Inertia-torque formula the (1.0.1) and (1.0.2) etc is parallelism, testifyed 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.

1.2 The total Inertia-torque of the rotational rigid body

The rigid body 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 a the 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 are 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.

So when a rigid body of fixed-axis rotation, be constituted by some particles. That it each particle, all have a mass the $\boldsymbol{m_i}$, and the force arm $\boldsymbol{r_i}$ of to the shaft. So the total Inertia-torque of this rigid body is:

$$I_{all} = m_1 r_1 + m_2 r_2 + \cdots\cdots + m_n r_n = \sum m_i r_i \tag{1.2.1}$$

1.3 The centroid-moment of the rotation rigid body

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

$$I_{all} = \sum m_i r_i \tag{1.3.1}$$

But the centroid-moment of the rotation rigid body, is say the rigid body total mass $\boldsymbol{M}_{all}$ and force arm $\boldsymbol{R_x}$ the product, is equal to the total Inertia-torque $\boldsymbol{I}_{all}$.

Namely: $$I_c = M_{all} \cdot R_x = \sum m_i r_i \tag{1.3.2}$$

The formula $\boldsymbol{I_c}$ represents the centroid-moment namely.

We have obviously: $$R_x = \frac{\left(\sum m_i r_i\right)}{M_{all}} \tag{1.3.3}$$

Namely total Inertia-torque $\boldsymbol{I}_{all}$ by total mass $\boldsymbol{M}_{all}$ divide, income force arm $\boldsymbol{R_x}$, is unique force arm to that rigid body centroid-moment $\boldsymbol{I_c}$ a correspondence. Because the $\boldsymbol{R_x}$ 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 $\boldsymbol{R_x}$, any other force arm $\boldsymbol{r_i}$.

It's all: $$I_{all} = M_t \cdot r_t = \sum m_i r_i \tag{1.3.4}$$

∴ $$M_t = \frac{\left(\sum m_i r_i\right)}{r_t} \tag{1.3.5}$$

In formula the $\boldsymbol{r_t}$ is a force arm but $\boldsymbol{R_x}$, $\boldsymbol{M_t}$ is relatively in total Inertia-torque $\boldsymbol{I}_{all}$ and force arm $\boldsymbol{r_t}$, 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 its 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.

$$M_t = \sum_{i=1}^{\text{all}} m_i + \sum_{r=1}^{\text{all}} m_r \tag{1.3.6}$$

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 rotation rigid body, if the force arm differ, 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 $\boldsymbol{Q}$ multiple, the mass of total burthen to change **1/** $\boldsymbol{Q}$ 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 $\boldsymbol{r_t}$ at the $>\boldsymbol{R_x}$, or $<\boldsymbol{R_x}$ it of both sides change. For example at $\boldsymbol{r_t}>\boldsymbol{R_x}$ and tends to infinity, the $\boldsymbol{M_t}$ tends go zero. Whereas when the $\boldsymbol{r_t}<\boldsymbol{R_x}$ and tends to infinitesimal, the $\boldsymbol{M_t}$ 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 rotation 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 measured.

1.4 The principle of Inertia-torque

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

$$I_{all} = m_1 r_1 + m_2 r_2 + \cdots\cdots + m_n r_n = \sum m_i r_i \tag{1.4.1}$$

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 $\boldsymbol{R}$ of the force arm, namely gained the rigid body of in force's arm the tangent direction burthen mass

$$\frac{I_{all}}{R} = \frac{\sum m_i r}{R} = M_R \tag{1.4.2}$$

In formula, the $\boldsymbol{M_R}$ been by force arm $\boldsymbol{R}$, that rigid body tangent the direction burthen mass.

From the level of the dynamics, the $\boldsymbol{M_R}$ in the force arm $\boldsymbol{R}$ tangent direction, match in the Newton second law. Namely:

$$F = ma = M_R \cdot \frac{R\theta}{t^2} = M_R R \cdot \frac{d^2\theta}{dt^2} = M_R R \cdot \beta \tag{1.4.3}$$

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

2 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 show, is the principle of a machinery scale or lever. In figure on the fulcrum $\boldsymbol{O}$ of the lever $\boldsymbol{L}$, its in both sides of lever $\boldsymbol{L}$ to the length and the weight of object, make it retain the equipoise.

The principle of the moment of force, be 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

Static-force. Therefore, namely: $$F_q = i\cdot(m\cdot a) = i\cdot(m\cdot\frac{d^2 l}{dt^2}) \quad (2.0.1)$$

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

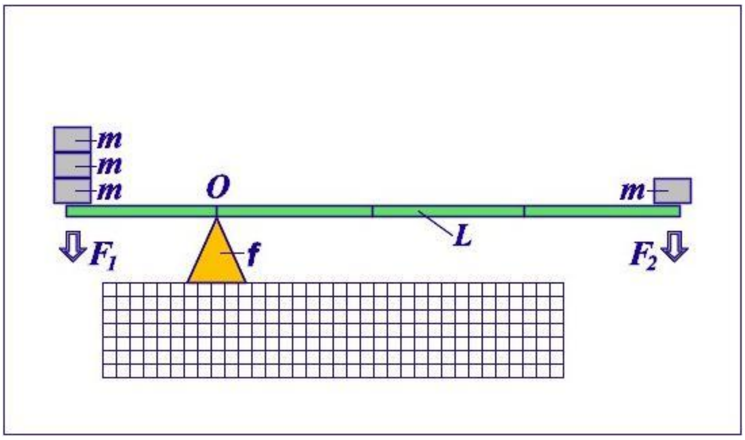

Figure 4 Moment of force in the statics

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:

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

So, the Static-force in by the product of its motion distance, equal the Static-force to does a work. This by in dynamics the force to does work, is alike. But its 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.

Static-force operation, is to conform the principle of force moment. 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:

$$\tau = \tau_1 + \tau_2 + \cdots\cdots = F_1 r_1 + F_2 r_2 + \cdots\cdots = 0 \quad (2.0.3)$$

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

State the force moment $\boldsymbol{\tau_1}$ and $\boldsymbol{\tau_2}$ direction is reverse. But when force moment direction reverse, the force(force moment) resists mutually, thereupon its operation is that quiescence, namely enunciation is a Static-force status operation.

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 vary 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 withstand, 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 operation of the force, make the movement status occurrence change of the object. In dynamics operation, 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.

3 The characteristics of dynamics of Inertia-torque principle

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

3.1 The rotation rigid body the linear momenta and angular momenta

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

$$I_{all} = m_1 r_1 + m_2 r_2 + \cdots\cdots + m_n r_n = \sum m_i r_i \qquad (3.1.1)$$

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

$$P_x = (M_{all} \cdot R_x) \cdot \frac{d\theta}{dt} = (M_{all} \cdot R_x) \cdot \omega = (\sum m_i r_i) \cdot \frac{d\theta}{dt} = (\sum m_i r_i) \cdot \omega \qquad (3.1.2)$$

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

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

Namely:

$$P_x = (\frac{1}{\rho} \cdot M_{all}) \cdot (\rho \cdot R_x) \cdot \omega \qquad (3.1.3)$$

The angular momenta of the rotation rigid body, that is the circle linear momenta and force arm the product. namely:

$$P_x R_x = m r^2 \omega \qquad (3.1.4)$$

On superficial, it is same to computing in the classical mechanics. But because the rotation linear momenta of the rigid body, is all same in its random force arm and radius R. So is in the R change, the angular momenta of the rigid body in fact is to R the geometric proportion change.

$$P_x R = (\sum m_i r_i) R \cdot \omega \qquad (3.1.5)$$

Thereupon according to Inertia-torque principle, on a rotation rigid body, in diverse force arm and radius R, its angular momenta is diverse. Any rotation rigid body, fact have diverse, multiple angular momenta. When its the R is big more, that is also big more its angular momenta. Contrarily, when its the R diminish, its the angular momenta also diminishes.

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

When external force is acted in rotation 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:

$$F \cdot R = I \cdot \beta = m \cdot \frac{du}{dt} \cdot r = m \cdot r^2 \cdot \frac{d\omega}{dt} \quad (3.2.1)$$

The I in the formula is to the point the moment of inertia, different from textual the Inertia-torque. 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 $\boldsymbol{R}$, its the mass of burthen the $\boldsymbol{M}$ is with the $\boldsymbol{R}$ inverse ratio change. Such as the formula (1.4.2).

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

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

$$U = R \cdot \omega = R \cdot \frac{d\theta}{dt} \quad \text{And} \quad a = R \cdot \beta = R \cdot \frac{d\omega}{dt} \quad (3.2.2)$$

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

$$F = m \cdot a = m \cdot \frac{du}{dt} \quad \text{And} \quad F = m \cdot a = m \cdot R \cdot \beta = m \cdot R \cdot \frac{d\omega}{dt} \quad (3.2.3)$$

Therefore, the particle the line velocity and acceleration and angular velocity and angular acceleration, with force arm $\boldsymbol{R}$ is to inseparable. So for a rigid body of rotation, when its angular velocity and angular acceleration is ascertained, by dissimilar the force arm $\boldsymbol{R}$ 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 $\boldsymbol{R}$ for direct proportion to change.

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

$$I = M \cdot R = \text{constant} \quad (3.2.4)$$

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

$$F = m \cdot a = M_R \cdot R \cdot \frac{d\omega}{dt} \quad (3.2.5)$$

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 its the external force of tangent line direction the size to direct proportion. But have nothing to do with the size its force arm. This complete 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 rotation 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:

$$dP = \int F dt \quad \text{and} \quad dP_\omega = \int \left(M_R \cdot R \cdot \frac{d\omega}{dt} \right) dt = M_R \cdot R \cdot d\omega \quad (3.2.6)$$

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 in the formula should for:

$$L = \int Udt \quad \text{And} \quad U = \frac{d^2 l}{dt^2} \cdot t = \frac{dl}{dt} \tag{3.2.8}$$

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 more big.

3.3 Multi-ply angular momentums and multi-ply rotation kinetic energy of the rotation rigid body

Any rotation rigid body, all such as this textual 3.1 section. When it have a the angular velocity that is certain, so correspondence in it of any radius R, the rotation linear momentum is all same. But the angular momentum of its rotation, then with radius R geometric proportion change.

$$P_x R = (\sum m_i r_i) R \cdot \omega$$

Therefore a rotation rigid body, have the multi-ply angular momentum. Conservation of angular momentum in the classical mechanics, for a particle or an object, encircle circular motion the circumstance, may be in point. That is because of the action of the centripetal force, when particle movement radius change, the centripetal force make its linear velocity become big or diminish. But according to the principle of Inertia-torque, a rotation rigid body has multi-ply angular momentum, therefore at this time angular momentum conservation, don't be meaningful (Besides because the Newton third law have been wrong by the proof[5,6], so similar particle circular motion such angular momentum conservation, also is not absolute).

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

$$P_x = (\frac{1}{\rho} \cdot M_{all}) \cdot (\rho \cdot R_x) \cdot \omega = m_r \cdot u_r \tag{3.3.1}$$

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.

$$(\frac{1}{\rho} \cdot M_{all}) \cdot (\rho \cdot R_x) \cdot \omega = (\frac{1}{\rho} \cdot M_{all}) \cdot (\rho \cdot U_x) = m_r \cdot u_r \tag{3.3.2}$$

So, a rotation 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, 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:

$$E = \frac{1}{2} mu^2 \quad \text{And} \quad E = \frac{1}{2} mr^2 \omega^2 \tag{3.3.3}$$

So than formula (3.3.2) and (3.3.3), the rotation 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 rotation rigid body and same rotation angular velocity ***ω*** , it in variant force arm ***r***, rotation kinetic energy is diverse.

$$\frac{1}{2}m \cdot r^2 \cdot \omega^2 < \frac{1}{2} \cdot \frac{1}{\rho} \cdot m \cdot \rho^2 \cdot r^2 \cdot \omega^2 \tag{3.3.4}$$

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

So, any a rotation rigid body, its rotation kinetic energy, don't is a single value. As if it is to has the multi-ply angular momenta, it also have the multi-ply rotation kinetic energy. Its rotation kinetic energy, at its rotation radius from small arrive the big that differ place, will display to is more and more big.

That a rotation rigid body has the multi-ply rotation kinetic energy, this a circumstance challenged the energy conservation law. Because, at need pass the collision, make rotation 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, its 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 a form is ambivalent. Because when the energy of the object, there is multiple value, be so it convert another the 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.

4 Rigid body by mulriple 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?

4.1 Rigid body much the count of force moment

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

$$-\tau = -\left(\tau_1 + \tau_3 + \cdots\cdots = F_1 r_1 + F_3 r_3 + \cdots\cdots = \sum_{i=1+2n}^{\infty} F_i \cdot r_i \right) \tag{4.1.1}$$

$$+\tau = +\left(\tau_2 + \tau_4 + \cdots\cdots = F_2 r_2 + F_4 r_4 + \cdots\cdots = \sum_{i=2+2n}^{\infty} F_i \cdot r_i \right) \tag{4.1.2}$$

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.

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

$$+\sigma = +\left(\sigma_2 + \sigma_4 + \cdots\cdots = F_{q2}r_2 + F_{q4}r_4 + \cdots\cdots = \sum_{i=2+2n}^{\infty} F_{qi} \cdot r_i\right) \quad (4.1.4)$$

In formula the $\boldsymbol{\sigma}$ is delegate the Static-force force moment. The Static-force force moment may have the direction, and also the possibility 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:

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

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

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, its the angular acceleration is a left hand turning or right hand turning. Or be quiescent, or be the rotation of nothing angular acceleration.

4.2 Rigid body by much the force moment for the action result

Because only 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.

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

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.

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

In formula the $\boldsymbol{\tau_f}$ be left hand turning and right hand turning the moment of force to mutually subtract, but obtain the true moment of force. It 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:

$$\pm\tau_f \mp \sigma = (-\tau)+(+\tau)\pm\sigma \quad (4.2.3)$$

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 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: $(\tau_f < \sigma) \Rightarrow 0$ and $(\tau_f - \sigma = 0) \Rightarrow m \cdot R \cdot \omega$ (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: $\tau_f = \tau_d + \tau_s$ But $\tau_s - \sigma = 0$ (4.2.5)

In formula the $\boldsymbol{\tau_d}$ is exceed Static-force moment of force part, the $\boldsymbol{\tau_s}$ is equal to the Static-force moment of force part.

$$\tau_d + \tau_s = \left(M_R \cdot R \cdot \frac{d\omega}{dt} \right) R + (m \cdot R \cdot \omega) \tag{4.2.6}$$

So, the $\boldsymbol{\tau_d}$ results in the angular acceleration of the rigid body. The $\boldsymbol{\tau_s}$ supports the rigid body overcomes Static-force the drag resistance force, but even velocity the rotation.

4.3 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 multi-ply the moment of force. Namely such as formula (4.1.1) or (4.1.2) show. 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 go which is the direction of rotation. Because the action of the force arm is very big at this time. When force arm is big, can use the small force, resisting the bigger force.

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

That:

$$(-\tau)+(+\tau)+(+\sigma) = \left(-\left(\overbrace{F_1 r_1 + F_3 r_3 + \cdots + F_{1+2n-2x} r_{1+2n-2x}}^{c} \overbrace{\cdots + F_{1+2n} r_{1+2n}}^{a} \right) \right) + \left(\overbrace{+\left(\sum_{i=2+2n}^{\infty} F_i \cdot r_i \right) + \left(\sum_{i=2+2n}^{\infty} F_{qi} \cdot r_i \right)}^{b} \right) \tag{4.3.2}$$

The size permutation of the force arm $\boldsymbol{r}$ of the formula inside moment of force, is same with $\boldsymbol{r}$ subscript number size permutation the direction. So when $\boldsymbol{r}$ of subscript of the number more big, $\boldsymbol{r}$ of the value is also more big. Suppose in formula the vinculum $\boldsymbol{a}$ the vector sum of moment of force, equal to vinculum $\boldsymbol{b}$ moment of force and the moment of force of Static-force the vector sum.

That:

$$(-\tau)+(+\tau)+(+\sigma) = -\left(\overbrace{F_1 r_1 + F_3 r_3 + \cdots + F_{1+2n-2x} r_{1+2n-2x}}^{c} \right) = -\tau_d \tag{4.3.3}$$

Namely left hand turn and right hand turn moment of force and the moment of force of Static-force the vector sum, equal to inside vinculum $\boldsymbol{c}$ the moment of force the vector 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 vector sum of the moment of force is that formula (4.3.3), so its force vector sum is:

$$F_f = F_1 r_1 \cdot \frac{1}{r_1} + F_3 r_3 \cdot \frac{1}{r_3} + \cdots = F_1 + F_3 + \cdots + F_{1+2n-2x} r_{1+2n-2x} \qquad (4.3.4)$$

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:

$$F = m \cdot a = M_R \cdot R \cdot \frac{d\omega}{dt} \qquad \therefore \qquad F_f = M_R \cdot R \cdot \frac{d\omega}{dt}$$

$$\therefore \qquad \frac{F_f}{M_R \cdot R} = \frac{d\omega}{dt} \qquad (4.3.5)$$

Therefore, use the vector sum of these force $\boldsymbol{F_f}$ 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 throw 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: $\left|-\tau\right| > \left|+\tau\right|$ So $\left(-\tau\right) + \left(+\tau\right) = -F_a r_a + F_b r_b = -F_x r_a$ (4.3.6)

Throw off the force arm ra: $$-F_x r_a \cdot \frac{1}{r_a} = -F_x = -M_r \cdot r_a \cdot \frac{d\omega}{dt} \qquad (4.3.7)$$

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

$$dP_x = -\int F_x dt = -\int \left(M_r \cdot r_a \cdot \frac{d\omega}{dt} \right) dt = -M_r \cdot r_a \cdot d\omega \qquad (4.3.8)$$

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 the arm of force, come the compare and the antagonize. Toing decide rigid body is a stillness or a rotation, and its rotation will 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.

5 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 ancientry 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 labor-saving? Is such? This point is in fact also not absoluteness.

Lever and moment of force the labor-saving, in the statics the levels, such as positive and negative direction the moment of force the 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 differ very much.

$$\left|-F_1\right| \geq \left|+F_2\right| \quad \text{or} \quad [F=(m\cdot a)] \geq [F_q = i\cdot(m\cdot a)] \tag{5.0.1}$$

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

Contrarily:

$$[\frac{F_1}{\rho}\cdot(\rho\cdot r)] \geq [F_2\cdot r] \tag{5.0.2}$$

Or:

$$[\frac{F}{\rho}\cdot(\rho\cdot r)] \geq [F_q\cdot r = i\cdot(m\cdot a)\cdot r] \tag{5.0.3}$$

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.

$$F = m\cdot a = M_R\cdot R\cdot\frac{d\omega}{dt}$$

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 labor-saving or is hard sledding.

$$\left(\frac{F_{q1}}{\rho}\cdot\rho\left(r\cdot S\right) = \frac{(i\cdot m\cdot\frac{d^2l}{dt^2})}{\rho}\cdot\rho\left(r\cdot S\right)\right) = F_{q2}\cdot r\cdot S \tag{5.0.4}$$

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 force. 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 have the value in the statics level.

6 Summing-up

Textual show Inertia-torque principle, the rigid body rotation law of the classical mechanics of verification is wrong, and adduce new rigid body rotation law of principle of the Inertia-torque. Textual attest, the rotation of the rigid body, have the multi-ply rotation kinetic energy. Is rotation radius more big in a rigid body, also its rotation kinetic energy is more big. Thereby rotation 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 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.

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