

Study on Inertia through Experiment on Inertia-Engine Designed and Built to Find out the origin Mystery of Inertia and Gravity

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ABSTRACT: Most noticeable scientists of the time, the Galileo, Newton and Albert Einstein has spent a lot on Gravity and Inertia but their origins remains mystery till now. This paper tries to reveals the origin cause of inertia and gravity (two greatest mysteries of science). An experimental setup named 'inertia-engine' has been designed and built in order to perform the tests on inertia and find out the true nature of inertial forces. The results found out of the experiment highly amazed and could not be explained through our well established laws of physics. The observations explore the new concept of 'variable (gradient)' field of spacetime (ST). The test results along with Noether's theorem and theory of relativity together help to hypothesis the origin mystery of Inertia & Gravity. The observational characteristic of inertia-engine leads major modification to the Newton's 3rd law of motion and explores the concept where spacetime (field) gets 'gradient' or 'curve' due to the acceleration of Mass. The experiment explores the relation of Energy generation/destruction with variable spacetime field. The paper resolves the controversy on 'inertial force' in classical mechanics to modify the foundation of physics to include inertia as real force. This experiment will explore a new era of fundamental inventions and discovery which was supposed impossible earlier.

I. INERTIAL FORCES AS REAL FORCE

As per the Newton's 3rd law of motion, all real forces must exist in pairs whereas 'inertial forces' do not exist in pairs. The 'possible real' nature of inertial forces will lead the violation of Newton's famous law of action-reaction and it is one of major reasons for the modern physics to consider inertial forces as fictitious force. Secondly, inertia being so fundamental that there exist almost no explanation in physics for its origin, so its origin is supposed to exist due to accelerated reference frame only.

It is to be noted that fundamental forces of nature like electromagnetic or Gravitation forces always requires atleast two body and acts intermediately on the bodies. The end forces are always being inertial ones. In other words we can say that fundamental forces are only interaction which requires two or more bodies (massive) whereas inertial forces can act on single body too. For inertial forces, it has been hypothesized that as the Mass gets accelerated, some mysterious kind of quantum field must get disturbed which resists the acceleration in form of **Inertia**. One thing is important here for the distinguishably between these that 'inertial forces' are generated by that field (only) without source¹⁻⁵ whether the 'fundamental forces' are exist due to both the 'field' with its 'source(massive)'.

If the origins of inertial forces are by some quantum field, then inertial forces should be real. To verify the concept we have designed and built an experimental set-up called 'Inertia-Engine' to perform tests on inertia in which the setup utilize the 'inertial force (centrifugal)' to drive the output load. The surprising observation leads to conclude that it is the 'spacetime' field which gets disturbed by acceleration of mass. In other words, symmetry of spacetime gets broken due to the mass acceleration and (the disturbed) spacetime field resist this symmetry- breaking (same as in higgs mechanism) in form of force which called as **Inertia (inertial force)**. Inertial forces originates when Mass accelerated and same way Centrifugal force originates due to surface-acceleration of body (mass). When the object accelerates and decelerates sinusoidally along (x) and (y) axis,

vector sum of inertial forces of both axis results into a force directed radial outward which we know as centrifugal force.

II. CENTRIFUGAL FORCE WITH NON-FIX CENTRE

When an object rotates about a fixed centre say in clockwise direction with a string, the object (mass) try to go radically outward direction and object always accelerates towards the centre. A (centripetal) force requires here as per the Newton's 2nd law of motion and the tension developed in the string is considered equal to the centripetal force. But which force causes tension in the string remains unknown.

People generally don't consider the significance of word 'fixed centre' in the rotation. The centre being 'fixed' means here that the centre is firmly connected with the Earth (where Earth is considered a rigid body). When object rotates, centrifugal force developed pulls the 'centre' radically outward direction (pulls away from centre). As centre is fixed to Earth means centrifugal force pull out the whole Earth. When (Earth as big mass) is acted by this force, it accelerated tiny, in fact rotated (surface accelerated) in counter clockwise direction at a negligible small radius (say point radius) due to Earth's heavy mass as compared to object's mass. The rotation of Earth's mass at this small radius generates centrifugal force in equal and opposite direction of centrifugal developed by object's rotation. This is similar to the binary stars (two bodies) system, but only difference is that one body (object) is too small in comparison to the other body (Earth).

Hence we can see here that the tension in the string developed is actually due to the centrifugal force generated by Earth's (point-radius) rotation, in fact tension developed between two equal and opposite centrifugal forces. Conclusively we can say that centrifugal force due to object's rotation provides centrifugal force to the earth and vice versa. We can also calculate the amount of energy require to accelerate any object. In this way, the energy needed for the rotation of object is provided by Earth and same way, equal energy needed for the rotation of Earth is provided by the object. And net energy in or out of the 'Earth-object' system remains zero.

In the experiment of 'inertia-engine', the centre of rotation is not connected firmly with the Earth; instead it is connected with a 'damping unit' of the engine which provides damping force as centripetal force for the rotation of object. The centre thus can move only of some degree of freedom. In this case net energy is not equal to zero of the system.

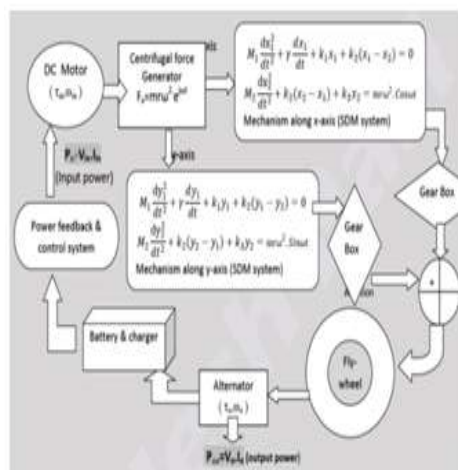


Figure 1a | Block diagram of working principle of Inertia-Eng

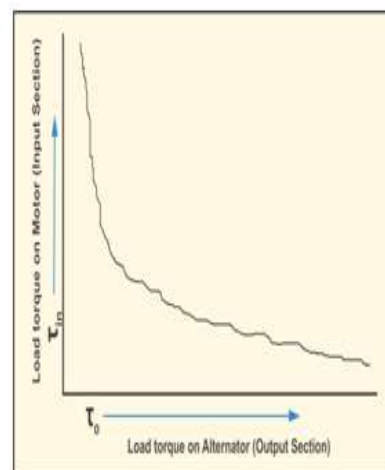


Figure 2 | Input vs Output Load characteristic of Inertia-Engine

III. DESIGN OF INERTIA-ENGINE (EXPERIMENTAL SETUP)

The working principal of inertia-engine in block diagram is shown in Fig.1a. In the design of inertia-engine, shaft of an electric motor (input power) is connected to rotate a metal-body of mass (m) as centrifugal generator. The job of the motor is only to rotate the metal-body at angular speed of (ω) and radius (r). The centre of rotation is not made fixed but connected with two 'spring-damper-mass (SDM)' system along (x) and (y) axis. The output section consists of alternator and flywheel with gear mechanism. We know rotational

motion requires two type of acceleration, one is **radial** and another is **angular** acceleration which are perpendicular to each other. Actually power dissipation of the alternator causes damping effect which is used to provide centripetal force for ‘radial acceleration’ for the rotation of metal-body. On other hand input power (motor) only provides ‘angular acceleration’ which increases angular speed of the metal-body. Rotation generates centrifugal force and this centrifugal force drives the output mechanism and alternator. The image of experimental set up of inertia-engine is shown in Fig.1b and rear side in Fig.1c.



Figure 1b | Experimental set up of inertia-engine



Figure 1c | Experimental set up of inertia-engine (rear side)

IV. OBSERVATION OF THE EXPERIMENT

When motor starts and rotates the metal-body (m), centrifugal force developed at the centre is tapped by mass-spring-damper (SDM) system along both axis and extracted power is fed towards the alternator through flywheel and gear-mechanism. The test was performed to figure out the speed–torque and Load characteristic [input (motor) vs output (alternator)]. The following shaking observation was found:-

4.1 As the load (current) on output alternator increase, it causes decrease in load on motor and vice-versa.

A very strange behavior of the engine has been seen. As the load (current) on alternator (output) is made to increase, the load (current) on driving motor (input) decreases. In inertia-engine, motor-shaft is neither connected and nor drive the output mechanism directly. As already said ‘centrifugal force’ generated due to metal-body rotation drives the output mechanism. Increasing the load on output section (alternator) increases the damping (effect) force through SDM system at centre of rotation. This damping force acts as ‘centripetal force’ requires for the metal-body rotation. As we know that rotation is a kind acceleration and this needs force in form of centripetal force. In the above experiment increase of load on alternator caused to increase the centripetal force which finally forced rotation speed of metal-body to increase. It becomes the compulsion of the rotation that speed must have to increase in order to compensate the increase of centripetal force. Finally the rotation speed increase due to its own caused load (current) to decrease on motor.

This is the most surprising and peculiar observation has been seen in the experiment tests in the inertia-engine. As the rotation speed increases, centrifugal force also gets increases which handle the extra load increase at alternator. So the increase load on alternator is handled by inertial (centrifugal) force, not by motor shaft torque. In fact inverse loading effect has been seen in the engine. Thus the prototype of inertia-engine acts like ‘**passive load inverter**’. This type of characteristic is seen in case of electronic transistors which are active devices where extra DC power source requires. In this case action-reaction force relation of Newton’s 3rd law of motion gets violated and observed experimentally. It can be stated that when any system is acted by inertia (inertial forces), the action force (F_a) on system is inversely proportional to the reaction force (F_b). Mathematically it can be expressed as,

$$F_a = \frac{1}{F_b} \quad (1)$$

In other way, Newton's 3rd law of motion gets modified in 'variable field of spacetime'. The observation results have been plotted in the graph shown in Fig. 2 for load torque of input driving motor shaft versus load torque at alternator shaft.

We can call the equation (1) as '**inverse action-reaction law**'. The equation explores the law behind the energy conservation in the vicinity of (spacetime) spacetime field which will be further explained in section 4.3. It has three statements viz.

- 1) Energy gets destroyed when work is done against force of inertia or in decreasing spacetime field wrt observers reference frame. $[(1 < F_b < \infty) \rightarrow (1 < F_a \leq 0)]$
- 2) Energy gets generated when work is done by the force of inertia or in increasing spacetime field wrt observers reference frame. $[(0 \leq F_b < 1) \rightarrow (\infty < F_a < 1)]$
- 3) Energy conservation law holds when above two statements occur adjacently or the observer is said to be situated in 'uniform' spacetime field which are common cases seen everyday life. $[F_b = F_a]$

4.2 Torque developed at the alternator shaft is proportional to the square of motor shaft speed and motor torque needed is proportional to the square of alternator shaft speed.

The load torque (τ_o) at output section observed proportional to the square of input angular speed (ω_{in}) of motor shaft which rotates the metal body (mass), i.e.

$$\tau_o \propto \omega_{in}^2 \quad (2)$$

While load torque (τ_{in}) at the motor shaft observed proportional to the square of output angular speed (ω_o) of alternator, i.e.

$$\tau_{in} \propto \omega_o^2 \quad (3)$$

In the experiment on inertia-engine, the efficiency of the Engine with on increasing of load as well as decreases of speed of alternator gets increase and vice versa. The speed torque characteristic is non-linear in nature.

4.3 Observational Conclusion

Not any machine or system shows such type of characteristic in the world in which output load of the machine becomes inversely proportional to the input load. The observation in fact directly indicates violation of Law of Energy & Momentum Conservation⁶⁻¹⁰. This can only happen when 'space-time' symmetries get broken¹⁰⁻¹³. As per Noether's theorem, conservation of Energy & Momentum can follows only in 'invariant' or flat space-time fabric¹¹⁻¹³. This means the rotation (acceleration) of mass have made the spacetime curve or symmetries of space-time to break here in this experimental setup when 'inertial forces' get involved.

If we hypothesized space-time fabric as quantum field of spacetime, the conservation laws of energy and momentum will follows in 'uniform' spacetime field only. The practical observation results indicates that spacetime field must gets 'varied or gradient' in the process of generation of inertial (inertia) force. In other words, Inertia is actually caused by 'varied or gradient' spacetime field or curve spacetime fabric. Einstein in his General theory of relativity explains origin of gravity is due to curvature of spacetime¹⁴⁻²⁰ and thus we can conclude the same 'variable' field of spacetime reveals the origin mysteries of both inertia & gravity which is explained in section 5 and 6.

V. ORIGIN MYSTERY OF INERTIA

Let an object of mass (**m**) is being accelerated at (**a**) in spacetime field. It is hypothesized that the phenomena breaks (make gradient) of the uniform spacetime field and intensity of field in forward direction get stronger. The gradient field of spacetime is depicted by using arrows which may call as 'inertial lines of forces' similar to magnetic lines of forces. As the body (mass) gets accelerated, the spacetime field quanta in front facing hits more and puts resistance for the acceleration of mass as shown in Fig.3. In other words, the spacetime field intensity in the front portion of mass (body) increases (become stronger temporarily as far as acceleration present) whereas in back portion intensity decreases (get weaker). Hence the concentration of spacetime field particles (quanta) is higher in front side and creates a force pressure across mass which tends to push the mass in back direction of the acceleration. It can be understood as the field pressure (opposite of

acceleration) multiplied by the mass of accelerated body creates inertial force which is equal and opposite of the initial force applied upon the body. This difference in ‘spacetime field intensity’ creates a pressure across the accelerated mass (object) which puts resistive force in the direction of the accelerated object, known as ‘inertial force’. This phenomenon is temporal as far as the body is accelerated.

Mathematically inertial force (f_i) is equal to the negative of Change of momentum of the object i.e.

$$f_i = -\frac{dp}{dt} \tag{4}$$

The ‘inertial force’ given in equation (4) is hypnotized as the first ‘fundamental force’ of nature. When a body accelerates inertia puts a resistive force in opposite direction to that of acceleration mediated by spacetime field quanta and hence inertial forces have to consider as real.

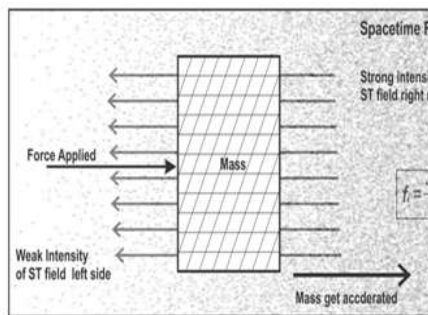


Figure 31 | Depiction of inertia (inertial force) by ILOF (inertial line of forces) in which direction of ILOF's shows the direction of inertia (inertial force)

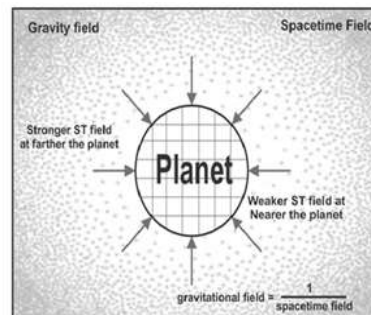


Figure 41 | Gradient spacetime field for gravity field. Higher density of dots denotes the strong intensity of ST field. Near the planet ST field intensity getting weaker and as to go in outer space ST field gets stronger.

VI. ORIGIN MYSTERY OF GRAVITY

This is the important section which explained the origin mystery of gravity. The gravity is considered to be the fundamental force of nature but in this paper, gravitation force is proposed to be a same force as of inertial force. Difference is only that gravitation is of permanent nature whereas inertial forces are of temporary nature. Gradient spacetime field is responsible for both gravity as well as inertia. It can be understood like the relation of electrostatic and magnetic force. Previously these two forces are known as separate forces but Maxwell unified these two forces and termed as ‘Electromagnetic Force’ whose mediating field quanta (boson) is ‘photon’. Same ways gravitational force can be unified with inertial force and may call it ‘Gravitoinertia Force’ whose field quanta will be ‘spacetime field quanta’.

Inertial force arises due to **temporal** deformation of ‘uniform spacetime field’ because of acceleration of matter whether ‘Gravitational force’ arises due to **permanent** deformation of the spacetime field (get gradient) in the presence of ‘fermions’ (matter). The matter (fermions) situated in ‘spacetime’ field and in this process field intensity of ‘spacetime field’ near the ‘fermions’ gets weaker. For example in the case of any planet, near the surface of planet intensity of spacetime field becomes weaker but gets stronger as go farther from the centre of planet. In the outer space the intensity of spacetime field approaching maximum with uniform intensity where gravitational field approaching zero as shown in Fig.4 and it is depicted through density of dots as supposed the density of spacetime field quanta. The field of gravitation and spacetime are inversely proportional to each other. We can say gravity field is nothing but the ‘gradient’ field of spacetime. Near the surface of any planet there exist different values of spacetime field at different points. Across any object the difference of this spacetime field intensity across the object (mass) puts pressure on the object (mass) towards its centre and we call this force, arising due to difference in spacetime field intensity, as ‘gravitational force’.

Mathematically, gravitational field is written as

$$\text{Gravitational field} = \frac{1}{\text{Spacetime field}}$$

or

$$g_f = \frac{1}{\phi} \tag{5}$$

Where ‘ g_f ’ be the gravitational field’ and ‘ ϕ ’ be the spacetime field’

General theory of relativity explains gravity as the curvature of spacetime in 2D (two dimension) flexible fabric whereas this theory explains the gravity in 4D assuming spacetime as quantum field whose intensity may be stronger or weaker at different points (stronger or weaker will always be relative). When intensity of the field is not uniform it can be said as curve spacetime. And the same curve or variable spacetime is responsible for inertial forces too. Mass have a property by which it makes the spacetime field weaker nearby it and hence spacetime field get stronger in outward (farther) side. This creates just a pressure which pushes the mass inwards (towards centre) and this way generates gravitational force. We can see that for gravity we need pressure from spacetime from large number of field particles hence gravity will be negligible at quantum scale of space. This way the theory eliminates hypothesis of 'graviton' particles for gravity to exist. The unification of gravity with inertia because of variable spacetime field would be the possible reason for equivalence of inertial and gravitational mass (principle of equivalence).

VII. CONCLUSION

The experimental observation on inertia leads to the violation of the laws of momentum and energy conservation. This paper explains several fundamental concepts which summarize in the followings points-

- 1) The most fundamental constituent of the universe is 'spacetime' field' and it is flexible. The intensity of spacetime gets varied (get gradient) by acceleration of 'mass'. Fundamental laws of physics changes as the intensity of spacetime changes. Most of the physics law deals only in fixed (non-variable) spacetime field. The current physics does not have any concrete and complete theory (except relativity) which could deals with variable field of spacetime.
- 2) The paper explains the origin of inertia as a resistance offered by gradient spacetime field to the mass and origin of gravity as the pressure exerted by gradient spacetime field upon the mass. Spacetime field being the reason behind both inertia and gravity also explains the principle of equivalence (reason behind inertial mass and gravitational mass to be equivalent).
- 3) The inverse action-reaction law tells how energy can be generated, destroyed or remains conserved in spacetime field.

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