INERTIA

According to 'MATTER (Re-examined)'

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Abstract: Inertia is a property that causes macro bodies to respond sluggishly to external efforts. Since no other entity that can prevent instantaneous action by external efforts on a free macrobody or maintain a macrobody's constant state of motion is known, the phenomenon of inertia is usually attributed to matter itself, in a negative sense. 3D matter is inert; it has no ability to move, act, or oppose external efforts. The property of inertia rightly belongs to the universal medium, whose action moves 3D material bodies. The property of inertia is due to the stabilisation process of the latticework structures in the universal medium. Only when the mechanism of action of external effort on an object and the mechanism of motion of 3D material bodies, as envisaged in the book 'MATTER (Re-examined)', are understood, will the nature of inertia be clear.

Keywords: Inertia, universal medium, effort, force, motion, work, matter, photon.

Introduction:

An alternative concept, presented in the book 'MATTER (Re-examined)', envisages a universal medium formed by 2D latticework structures (called 2D energy-fields) by quanta of matter. 2D energy-fields, formed by quanta of matter separately in each plane, have independent existence and extend infinitely in all directions in space. All possible spatial planes have one 2D energy-field, each. Together, they create an all-encompassing universal medium with definite structure and properties that fill the entire space. The universal medium is inherently under compression. An action by an effort distorts the latticework structures of 2D energy-fields. Reaction from the distorted latticework structures tends to restore the stability and homogeneity of the 2D energy-fields. Due to the inherent stability of 2D energy-fields, structural distortions in the universal medium are transferred in the direction of action unless removed by an opposing action. All 3D material bodies exist in the universal medium, which is in direct contact with every basic 3D matter-particle. A 3D matter-particle, that happens to be in the region of structural distortions in the universal medium that are being transferred, is carried along with the distortions. Motion of the constituent 3D matter-particles culminates in the displacement of a macrobody. The macrobody will continue to move at a constant speed as long as the structural distortions are present in association with the macrobody. This phenomenon is the inertia. The time duration required for the stabilisation of the 2D energy-fields, during and after an action by an external effort, causes inertial delay. All conclusions, expressed in this article, are taken from the book, 'MATTER (Re-examined)' [1]. For details, kindly refer to the same.

Inertia:

By the law of inertia, deduced from his experiments with balls rolling down inclined planes, Galileo was able to explain how it is possible that we do not sense motions of the Earth. Since we are in motion together with the earth and our natural tendency is to retain that motion, the earth appears to us to be at rest. Newton's first law is known as the principle of inertia. According to this law, depending on its initial state of motion, *'a body with no net force acting on it will either remain at rest or continue to move with uniform speed in a straight line'.* The distinction between states of 'rest' and 'uniform motion in a straight line' is only superficial. They may be regarded as the same state of motion seen by different observers; one moving at the same velocity as the moving body, the other moving at constant velocity with respect to the moving body. [We should also note that no macrobody can remain static in space]. Historically, we may consider this principle of inertia to be the starting point and a fundamental assumption of classical mechanics. No logical cause or mechanism of action could be provided for this peculiar behavior, associated with macrobodies. Hence, this behavior was simply assumed as a property of the most obvious entity that could be observed – the matter.

Inertia is an observed tendency, attributed to material bodies. It need not be a property of matter. Material bodies appear not to respond instantaneously to the action of an external effort. This delay is not necessarily due to any property of the material body. However, since no other entity that can cause such a delay in the action of an effort is observed, the property of inertia is attributed to a material body (which is under action) without any logical basis. While considering the motion in a circular path, pseudo 'centrifugal force' is often thought to be caused by the inertia of a moving macrobody. In some other cases, it is proposed that gravity and inertia always work (simultaneously) against each other, and in proportion to an object's mass. Einstein reinforced the relationship between gravity and inertia by declaring their equivalence.

The word 'inertia' is related to the word 'inert', which means '*without inherent power of action, motion, or resistance*'. In physics, inertia is defined as '*the property of matter by which it continues in its existing state of rest or motion unless an external force is applied*'. Inertia is characterized by a material body's 'heaviness' or its lethargy to move. This is not a property of matter because matter cannot act or move by itself, but it is only an attributed property of matter. All 3D material bodies are inert. Hence, it is incorrect to assume that 3D material bodies interact with each other. Every action has to have a cause. The motion of a 3D material body is an action, and it has to have a cause. Since 3D matter is inert, a macrobody cannot cause its own motion or inertia associated with it. Macrobodies need an agency to act on them or to produce apparent interactions between them. This agency is external to the 3D material bodies and acts as an intermediary agency between apparently interacting macro bodies. In fact, intermediary agency acts on each of the macro bodies separately, and the result of simultaneous actions on different macrobodies, when considered together, appears to be an interaction between them.

Nature of inertia:

An entity may have a number of properties or qualities. One or more of its properties or qualities may describe this entity. However, an entity may also be indicated by a quality or property it may not have. The quality or attribute is a functional character that an entity has. A character that is absent from an entity is not one of its qualities. Inability to move or act is not a characteristic property. Hence, inertia, taken in the above sense, is not a property of an entity. It describes a property the entity does not have. It is describing a property in a negative sense.

An external agency is required for the movement of a macrobody. If this external agency has the ability to move macrobodies, the property that causes a delay in action, it is one of this external agency's qualities. A property of a macrobody, expressed in a negative sense, can mean a property of external agency, expressed in a positive sense. Thus, inertia can mean a property of external agency to cause a delay in the motion (or change in rate of motion) of a macrobody.

Inertia is a passive property. It can only oppose the efforts ('forces' or 'torques') by active agents. A macrobody moves at a constant linear speed not because of its inertia but only because of the absence of effort by the external agency to slow it down, change its course, or speed it up. Inertia appears or is present only during a change in a macrobody's state of motion. Inertia does not act on a macrobody in any manner. The cause of motion does not affect the development or magnitude of inertial measurements. Whichever natural phenomena or effort (natural force) cause the macrobody's motion, development, and magnitude of measurements related to inertia are the same.

In physics, the quantitative measure of inertia is considered a fundamental property of all matter. It is so, by virtue of which a macrobody opposes any agency that attempts to put it in motion or (if the macrobody is already moving) to change the magnitude or direction of its linear or rotational velocity. Inertia is a passive property that does not enable a macrobody to do anything except oppose such external active agents. Inertia is a 'resistance' that a macrobody appears to offer to a change in its speed or position upon application of an effort (force). Even though the macrobody does not or cannot do anything to offer or change this resistance, this behavior – observed with respect to its motion – is attributed to the 3D material body, only because of the lack of another observed external agency.

If it is appropriate to understand inertia as a property that invokes resistance to change of state of motion of a 3D material body, the word 'resistance' acquires special significance. Resistance is developed during relative motion between (at least) two entities in contact. This implies that a 3D material body, during its change of state of motion, has a relative motion with respect to another entity, which is in direct contact with it. And during its constant state of motion, a 3D material body experiences no inertia. This implies that during a steady state of motion, there is no relative motion between it and the external agency.

To understand the true nature of inertia, it is necessary first to understand the nature of external agency that moves 3D material bodies and the mechanism of motion. The mechanism of motion of a 3D material body includes the mechanism of action or application of effort (work). This was always a mystery. By logical consideration, no 3D matter-body can move on its own. It was also not logical to consider that a 3D material body can affect the state of motion of another, without making direct contact. Yet in nature, 'action at a distance' is observed, and the efforts ('forces') appear to act on 3D matter-bodies through empty space. The only logical conclusion is that there is an unobservable intermediary agency between (apparently) interacting 3D material bodies.

In the past, many intermediary agencies or media, like different types of aethers, diverse fields, etc., were proposed. Being very vague, none of them stood scrutiny for a long time. Although each of them had characteristic properties to suit the corresponding (mathematical) theory for which it was proposed, none of them had rational constituents or logical structure. Although the existence of intermediary medium is not acknowledged anymore, we do use many entities (like various undefined fields, mysterious imaginary particles, formless and structure-less entities, mathematical constructs, etc.) to facilitate mathematical understandings and coherent (?) explanations of various phenomena. This only indicates a dire necessity for a logical, all-encompassing universal medium, structured by real entities. Since no logical external agency is theorized or accepted, so far, the mechanism of action continues to remain a mystery. Therefore, we were compelled to assign the property inertia, which rightly belongs to unobservable (and undefined) external agency, to the observable 3D material bodies in a negative sense.

An alternative concept, presented in the book, 'MATTER (Re-examined)', proposes a universal medium that fulfils all requirements needed in various theories. The whole concept is based on a single assumption that the 'Substance is fundamental and matter alone provides substance to all real entities'. Universal medium has only one type of real matter-particles as its constituents – the quanta of matter. Inherent properties of quanta of matter help them to logically structure a universal medium that fills the entire universe, outside the most basic 3D matter-particles. The universal medium is a combination of 2D energy-fields in all possible planes in space. 2D energy-fields have quanta of matter as their constituents and definite lattice structures. All actions on or by macrobodies and apparent interactions between them are results of the inherent property of the latticework structures of 2D energy-fields to attain homogeneity and serenity. Acceptance of the universal medium can remove all mysteries present in physical science today.

Structural distortions in 2D energy-fields, associated with the macrobody, are work done in or about it. Changes in the associated work change the state of motion of the macrobody. The structurally distorted region in the universal medium, in and about a macrobody, is its 'matter-field'. Inertial delay is caused by the time required for the stabilization of structural distortions in the matter-field during variation in the magnitude of additional work in and about a macrobody. Additional work, done in and about a macrobody, is the magnitude of 'additional distortions' in its matter-field, which determines its state (of motion). Intrinsic work in and about the matter-field of a macrobody is the structural distortions required for the development of the macrobody and sustenance of its stability and integrity.

Measurement of inertia:

Depending on the type of macrobody's motion (linear or angular), inertia is numerically determined in two scales. Resistance offered to a change in the macrobody's state of motion may be quantified in terms of the external effort on it and the change in its state of motion. The magnitude of resistance may be understood as equivalent (not equal) to the magnitude of action associated with the macrobody that invokes inertia. There are two types of numerical measures of an action that invoke the property of inertia.

Inertia of a macrobody, in relation to its linear motion, is its 'mass'. A macrobody's mass governs its resistance to the action of an external effort (force), acting in a direction through the centre of the macrobody's 3D matter-content. Since the magnitude of resistance is proportional to the magnitude of its matter-content, the mass of a macrobody is generally understood to represent the magnitude of its 3D matter-content. Note that mass and effort are defined on a mutual basis – by circular logic. Both inertia and gravitational attraction have nothing to do with the mass of a macrobody, which is a mathematical relation between the external effort (force) on it and its acceleration. Therefore, differentiation of inertial measurements into 'gravitational mass' and 'inertial mass' is arbitrary.

A macrobody's 'moment of inertia' or 'rotational inertia' about a specified axis measures its resistance to the action of an external effort (torque) about the same axis. This axis could be through or outside the

rotating macrobody. The greater the mass or moment of inertia of a macrobody, the smaller is the change produced by an action (by the applied effort). The moment of inertia of a macrobody about an axis is the sum of moments of all its 3D matter-particles, about the specified axis. The magnitude of the moment of inertia depends not only on the 3D matter-content of the macrobody but also on the parameters of the axis chosen. For the same macrobody, depending on the axis chosen, different magnitudes of resistance may be exhibited.

In mechanics, generally, relative reference frames are used to describe actions. In this, a static macrobody is assumed as a reference in space and relates the motions and locations of all other macrobodies with the chosen reference. Displacement of the reference point/body (or an action on it) is automatically assigned to the referred bodies (in the opposite direction) instead of the displacement of the reference body. By assuming the reference body to be stationary and taking the relative motions of the referred bodies as true parameters, their true parameters and movements are greatly altered. The use of altered parameters to determine physical actions by/on the macrobodies results in incorrect parameters and a false shape of their paths.

The method of relative reference frame is very simple and gives accurate results for the relative positions of corresponding macrobodies. However, this method can give only apparent results for all other parameters of the corresponding macrobodies. For identical changes in the states of motion of the referred and the reference bodies by the actions of external efforts, no inertial effects are obtainable on the referred macrobody. Although an external effort has acted on the referred macrobody, its state of motion does not indicate a change. Hence, only actions, considered with respect to an absolute reference, can give real parameters and correct shapes of paths of various macrobodies considered. As the universal medium, provided by the 2D energy-fields, is moderately static and homogeneous, it can provide an absolute reference. Inertial measurements of a macrobody are affected by the use of its apparent parameters, with respect to the relative reference frame.

Inertial motion:

Displacement of a macrobody in space that gives rise to the phenomenon of inertia is envisaged as ‘inertial motion’. Any action that results in the displacement of a macrobody in space is an inertial motion. The action of an effort on a macrobody results in additional work in its matter-field. The mathematical relationship between the variation in the rate of change of displacement (acceleration) and the 3D matter-content of the macrobody (represented by its mass) is the ‘force’. Hence, the action of effort (or force) is the change of additional work developed on or about a macrobody. As long as the macrobody keeps its stability and integrity, the intrinsic work associated with it does not change. Hence, we will not consider intrinsic work associated with a macrobody in this article.

The causes and mechanisms of motions of macrobodies have logical explanations [1]. 2D energy fields in the universal medium are the moving agencies of a macrobody, and the mechanism of motion is entirely a part of the universal medium’s inherent property to strive towards absolute homogeneity. Transfer of structural distortions in the latticework structures of 2D energy fields displaces the basic 3D matter-particles in them. As the mechanism of motion is fully contained in the universal medium, inertia becomes a property of the universal medium. When inertia is considered to be a property of the universal medium, the mass of a macrobody becomes the measure of the ability of the universal medium to cause motion or to change the rate of motion of the macrobody. Since the measure of this ability (in case of linear motion) is related to the 3D matter-content of the macrobody, it can be considered to represent the quantity of (material) 3D matter, in the macrobody, under static conditions.

During the creation of the basic 3D matter-particles (from the disturbance in the universal medium [1]), the surrounding universal medium is structurally distorted by gravitational actions. The shape of a basic 3D matter-particle causes differences in the distortion-density in the surrounding universal medium. Universal medium tends to equalise the distortion-densities in different regions by transferring structural distortions from the regions of higher distortion-density to the regions of lower distortion-density. During the transfer of structural distortions, basic 3D matter-particles in the region are also moved along with the structural distortions and thus cause their linear motion at the highest possible linear speed – speed of light – and spin speed proportional to their 3D matter-contents. Basic 3D matter-particle, created by the universal medium, and associated structural distortions around it, together form a corpuscle of radiation (light) – a photon [1].

The linear speed of a photon (light) is limited by the ability of the universal medium to move its constituent quanta of matter, without its own structural breakdown. The absolute linear speed of a photon remains constant, irrespective of any other action on it. As the linear speed of a photon cannot be modified, it does not qualify as an inertial motion. Therefore, inertial laws are not applicable to the motions of photons.

If the action of an external effort tends to affect photons' linear speed along their (curved) paths in primary 3D matter-particles, the photons gain or lose 3D matter-contents. If the action tries to slow down the photons, they lose 3D matter-contents and lower their frequency. This process is the heating. 3D contents, lost from the photons, may form new photons and radiate away from a hot body. If the action tries to speed up the photons, they acquire 3D matter-content from the surrounding universal medium and increase their frequency. This process is cooling. Currently, heating and cooling are not considered inertial actions.

Photons form all other superior 3D matter-bodies found in nature. While they are part of superior 3D matter-particles, photons are confined to move in circular paths, within the corresponding primary 3D matter-particles. Critical linear speeds of photons are maintained in their curved paths even when they are part of fundamental particles/macrobodies. Depending on the distortion-density on either side of the curved path of its linear motion, a photon may also simultaneously move sideways by the transfer of structural distortions in that direction. Actions by the universal medium move a macrobody by displacing its primary matter-particles sideways without affecting constituent photons' critical linear speeds.

Sideways displacements of photons, along with superior 3D matter-particles/macrobody, are bound to produce additional structural distortions in the surrounding matter-field, which correspond to the displacement of the macrobody. Once produced, the additional structural distortions tend to be transferred in a straight line, indefinitely at a constant velocity through the universal medium. Constituent 3D matter-particles of the macrobody continue to move along with them. This process of motion continues until additional structural distortions in the matter-field of the macrobody are removed or varied in magnitude by another set of additional structural distortions.

The development of structural distortions in the universal medium necessitates the displacements of constituent quanta of matter in the latticework structures of corresponding 2D energy fields. Displacements of quanta of matter and hence, the development of structural distortions in the universal medium are work done. Structural distortions in the universal medium strain the inherently stable latticework structures to produce stress in them. Stress in the universal medium is the 'energy' associated with the work (structural distortions). Since energy is proportional to the work, for practical purposes, they may be considered synonymous. Work is a real entity, and energy is its shadow. The 'energy' is a functional entity. Energy has no independent existence. Transfer of work (structural distortions) in the universal medium is synonymous with the transfer of energy.

Displacements of constituent quanta of matter in the universal medium to produce structural distortions (work) take time to accomplish. Hence, work is done slowly and progressively by an effort. No inertial effort can act instantaneously. Additional work, done in the macrobody's matter-field, needs time to rearrange and stabilise the structural deformation in the latticework structures of 2D energy-fields. During this time, the macrobody is in the acceleration/deceleration stage. By the time the additional work in the macrobody's matter-field is stabilized, the macrobody's acceleration/deceleration period is complete. [The fact that acceleration and deceleration periods are essential for the stabilisation of additional work, irrespective of continued action of external effort, is often overlooked]. Thereafter, the macrobody is carried at a constant linear velocity by the structural distortions, being transferred through the universal medium.

Additional structural distortions in the matter-field of a macrobody can also be supplied by inertial action by another macrobody. Let us consider a moving macrobody 'A' making contact with a static (or slower moving macrobody in the same direction, macrobody 'B'. Presence of macrobody 'B' restricts free motion of macrobody 'A', as dictated by the additional structural distortions in its matter-field, moving in the universal medium. However, 3D matter-particles of the macrobody 'B' cannot restrict the additional structural distortions in the matter-field of macrobody 'A' from encroaching into its own space. Part or full of additional structural distortions, associated with the macrobody 'A', advance into the space occupied by macrobody 'B'.

As the additional structural distortions continue to be transferred through the space occupied by the macrobody 'B', its 3D matter-particles also are carried along with the additional structural distortions. Motion

of macrobody 'A' is now transferred to macrobody 'B', partially or in full. If the whole of additional structural distortions in the matter-field of macrobody 'A', is transferred into the space occupied by macrobody 'B', the macrobody 'B' moves at linear speed corresponding to additional work (energy), it received from macrobody 'A' and macrobody 'A' comes to a stop. If the transfer of additional structural distortions is partial, both macrobodies continue to move at linear speeds corresponding to additional work (energy) associated with each of them. Additional work (energy) lost from the matter-field of macrobody 'A' is equal to additional work (energy) gained by the matter-field of macrobody 'B'.

For the transfer of inertial motion from one macrobody to another, it is essential that the 'force-receiving body' is moving at a slower linear speed compared to the 'force-applying body'. If the 'force-receiving body' is already moving at the highest possible linear speed through the universal medium, no additional structural distortions, in the direction of its motion, can be transferred into its matter-field. This is because the speed of transfer of structural distortions cannot exceed the highest linear speed permitted in the universal medium. In such cases, the mass of the 'force-receiving body' reaches infinite proportions. This requirement of lower linear speed of 'force-receiving body' restricts the efficiency of applied effort on a macrobody, in the direction of its linear motion, and causes the phenomenon of 'relativistic mass'.

2D energy-field, in each plane, is structured into a latticework formation. Additional work about a moving macrobody, in the form of additional structural distortions in it, causes the latticework structures to compress in the direction of motion of the macrobody, by a certain magnitude, proportional to the magnitude of the macrobody's linear speed. As this compression is in a linear direction, it helps the latticework structures in the macrobody's matter-field to reduce in length (in the direction of its linear motion) and expand in perpendicular directions of its linear motion. Macrobody as a whole contract in length (in the direction of its linear motion) and expands in planes perpendicular to the direction of its linear motion. Magnitudes of these contractions in length and expansions in girth are proportional to its linear speed.

Should the direction of transfer of additional structural distortions and the direction of motion of the macrobody not be co-linear, transfer of additional structural distortions can affect the macrobody only as long as it is in the path of the moving additional structural distortions. Thus, the planetary bodies moving in orbital paths about a central body experience a higher 'central force' towards their rear ends compared to their forward ends. The centre of gravity of a free orbiting planetary body shifts to the rear from the centre of its 3D matter-content (mass). This phenomenon causes the accelerating spin motion of the planetary bodies in the plane of their orbital path.

Irrespective of the nature of action (electric, magnetic, nuclear, mechanical, etc.), all actions are understood by the inertial motions of 3D material bodies that they produce. Force, being a (mathematical) relation between the rest mass of a macrobody and the rate of change of its speed (due to an effort), is identical in all cases of actions. Hence, there is no meaning in differentiating the efforts into different categories, depending on the phenomena producing them. All efforts and their actions in nature are similar. Only the differences are in the phenomena producing them. Hence, fundamentally, there is only one type of effort (force). Different manifestations of efforts are categorized into various 'natural forces'.

Mechanism of inertial action:

The speed of transmission of additional structural distortions in a macrobody's matter-field depends on their magnitudes. In the 3D spatial system, only the inertial nature of efforts can transfer tangible work from one macrobody to another. Inertial efforts may be transmitted at any speed but less than the speed of light. The highest linear speed possible is limited by the ability of the macrobody's 3D material particles to maintain their integrity.

Effort (force) is recognised by its inertial action on 3D material bodies. Displacements of 3D matter-particles are necessary to create inertial actions. Inertial efforts are applied from outside a macrobody. Additional structural distortions, produced by the inertial efforts in a macrobody's matter-field, are invested from external sources. Such investments may be carried out either by the 'field efforts', by gravitation, or by the motion of external macrobodies towards it. Additional structural distortions (corresponding to an inertial action) may be created within a macrobody's matter-field, by the movements of its constituent 3D matter-particles or by direct transmission of additional structural distortions from the matter-field of a 'force-applying body' into the matter-field of the 'force-receiving body'. Inertial actions on constituent 3D matter-particles of a macrobody, within its border, are restricted within its matter-field. They do not change the state of motion of the whole macrobody. Hence, inertial actions confined within the matter-field of a

macrobody do not contribute to the inertial actions of the whole macrobody. Internal efforts cannot modify the state of motion of a macrobody.

(Matter-fields of) two macro bodies are differentiated by additional structural distortions associated with their individual matter-fields within their borders. A plane, passing through both macro bodies has the same 2D energy-field is passing through both macrobodies. Nevertheless, parts of the 2D energy-field, within the borders of each, are distorted appropriately for the state of motion of each of them and are parts of their separate matter-fields. Therefore, when it is said that a macrobody is under the action of another macrobody, it means that additional structural distortions in the matter-field of one macrobody are brought to bear upon the additional structural distortions in the matter-field of another macrobody. 3D matter-particles of the macrobodies do not come in contact with each other during a collision between the macrobodies. When a macrobody is said to meet or collide with another macrobody, it is their matter-fields, that meet or collide. In the process, both matter-fields (being part of the same latticework structure) try to modify each other by sharing total additional structural distortions. A collision between the matter-fields, depending on the strength of the collision between two macro bodies, transfers part of the additional structural distortions in them to each other. Since no transfer of 3D matter-content takes place, macro bodies' 3D matter-contents are not affected (in usual cases).

Introduction of additional structural distortions from external sources varies the magnitudes of structural distortions already existing in the matter-field of a macrobody. Variation in the magnitude of structural distortions changes stress at the junction-points in the latticework structures of 2D energy-fields. Stress developed in the arms of a latticework-square, transfers part of the deformation to the next latticework-square in front of it. Similar actions are repeated sequentially forward in the direction of external effort. Because of the latticework structure of the matter-field, no single latticework-square can be deformed or strained in isolation. Due to the interlinking of latticework-squares, strain in one of them is automatically transferred and shared by neighbouring latticework-squares in the same plane.

Additional structural distortions, introduced by an external effort, are progressively absorbed by the latticework-squares of the macrobody's matter-field, allowing them to be strained and distorted. Latticework-square, nearest to the point of application of the external effort, is distorted by the highest magnitude, the latticework-square next in front is distorted to a lesser degree, the latticework-square next in front is distorted to still lesser degree and so on. Due to the fluidic property of the universal medium, once the process of transfer of structural distortions starts, it would continue indefinitely (similar to wave motion in an ideal fluid), unless modified.

In fact, it is the structural distortions in the latticework structure, containing additional work, which are transmitted. Constituents of a latticework-square move only so much as required to store the work of its share. The rest of the work is transferred to the next latticework-square and so on. During the transmission of structural distortions, each latticework-square of the 2D energy-field absorbs part of the work by remaining in a distorted condition to a certain degree and passes on the rest of the distortion to subsequent latticework-squares. As and when the whole of the additional structural distortion received by one latticework-square, is transferred to the next one, each latticework-square returns to its original state. Additional structural distortions received by a matter-field, progress in the direction of the external effort, while latticework-squares of the 2D energy-field remain in place, in space.

Nature of inertial motion:

When a macrobody is moving under the action of additional structural distortions in its matter-field, it is being displaced with respect to the universal medium. The matter-field of the macrobody is moving. It is the additional structural distortions in the latticework structures that are transferred. 3D matter-particles of the macrobody are carried along with the matter-field. The 2D energy-fields are in constant existence throughout space. Therefore, wherever the macrobody is in space, it has similar 2D energy-fields about it. Hence, it is impossible to determine the relative motion between a macrobody and the universal medium.

We may determine a macrobody's motion with respect to other macro bodies or other references in the 3D spatial system, like a point in the universal medium. Universal medium, in this concept, is the equivalent of 'aether' in 'aether theories' or 'fields' in 'field theories'. Constituent 3D matter-particles of the macrobody are moved with respect to the latticework structures of 2D energy-fields. Although the 2D energy-fields are steady in space, it is the additional structural distortions in them that are moving and carrying the 3D matter-particles of the macrobody. Because of this arrangement, even though the 3D matter-particles

are moving with respect to the static 2D energy-fields, no resistance is offered by the universal medium to the movements of the macrobody or its 3D matter-particles. It is like a macrobody has no displacement relative to the universal medium while it is moving through it.

A macrobody, moving through the universal medium, does not suffer drag or resistance. No 'aether drag' or 'aether wind' can be detected about a moving macrobody, however large the compound-macrobody may be or however fast its motion may be. Because the equivalent of 'aether' in this concept (universal medium), does not move itself but moves the macrobody by its actions. However, since the structural distortions in the universal medium are moving along with the macrobody's 3D matter-particles, effectively, there is no relative motion between the macrobody and the universal medium.

Additional work invested in the matter-field of a macrobody takes certain time (inertial delay) to stabilize itself and provide the macrobody with a constant linear speed. This is true even after the external effort is terminated. Additional work, introduced in the matter-field and not yet stabilized before the termination of the external effort, continues its stabilization in the normal course of time. Ignoring this factor hinders our understanding of the instantaneous direction of motion of a macrobody, moving along a curved path. Currently, it is believed that the instantaneous direction of motion of a macrobody, moving in a circular path, is tangential at any location in the circular path. In reality, the instantaneous direction of motion of a macrobody, moving in a circular path, is deflected outward from the tangent to the curved path [1]. Radial component of the macrobody's motion gives rise to an imaginary external effort, the 'centrifugal force'. Fictitious efforts (like centrifugal force, currently called inertial forces), invoked by the imagination of the observer to maintain the validity of present theories and apparent forces, related to different frames of reference, are not considered to be real efforts in this concept. They serve for easier but irrational explanations and understanding of various phenomena.

Since additional structural distortions are transferred in the 2D energy-fields and all 2D energy-fields exist in their own planes, a matter-field can be transferred only in a straight line. Each 2D energy-field, passing through the macrobody, transfers additional structural distortions in its own plane. Hence, all inertial motions are in straight lines (rotational motion is a combination of straight-line motions). Linear inertial motion of a macrobody continues indefinitely in a straight line until the macrobody is affected by another external effort.

Once a certain magnitude of additional structural distortions is introduced into the matter-field of a macrobody, it remains permanently with it and continues to keep the macrobody in its current state of motion indefinitely, until the additional structural distortions are lost, modified, or removed (neutralized by additional distortions in the opposite direction) from the matter-field by another external effort. Since additional structural distortions (introduced by an external source) in the matter-field are associated with 3D matter-particles, the speed of their transfer is limited by the magnitude of additional structural distortions. Hence, a macrobody may move at any speed, lower than the highest permitted speed by the universal medium. As the linear speed of a macrobody increases to a high value, constituent 3D matter-particles of the macrobody break down to inferior 3D matter-particles until the macrobody's speed reaches the linear speed of light. At the linear speed of light, only photons from a macrobody can survive. Beyond this linear speed, no matter-particle can move. This limits the speed of 3D matter-bodies in space to much less than the linear speed of light. Gradually, even the photons revert to quanta of matter in the universal medium.

Since a 2D energy-field extends only in one plane, no structural distortion in its lattice structure can be transmitted directly into the third spatial dimension. Transmission of structural distortion is restricted to the plane of the corresponding 2D energy-field. A 3D matter-particle simultaneously occupies gaps in many 2D energy-fields (3D space) in the same location. Structural distortions in all these 2D energy-fields, act on the 3D matter-particle, in their respective planes to move it. 3D matter-particle, being three-dimensional, produces additional structural distortions during its motion in all 2D energy-fields occupied by it. In this way, structural distortions in one 2D energy-field may be transferred or transmitted to other 2D energy-fields, indirectly. Effort (presumably) acting through the universal medium on a 3D matter-particle, has its components in one or more 2D energy-fields in all planes occupied by it. Actions by various 2D energy-fields, together, produce straight-line transmission of structural distortions in the 3D spatial system.

Range of inertial action:

Consider a small hypothetical direct (point) effort, applied to a junction-point of a latticework-square in the matter-field of a macrobody. To do work, there must be movement. Assuming the point of application has moved by a small distance, along with the other quanta of matter attached to the junction point, the

effort can be regarded as having acted on the macrobody. Certain additional work is done in its matter-field by making a change in it, namely, the movements of certain quanta of matter in relation to others.

Movements, produced in the matter-field, are as follows: the first latticework-square in line of external effort is deformed to a maximum (corresponding to the strength of effort), the next latticework-square in front is deformed to a lesser degree, and the next latticework-square in further front is deformed to a still lesser degree, and so on, up to the range of action of the effort. This process continues until a latticework-square at a certain distance from the point of application of effort is not deformed at all. Each latticework-square preserves a certain amount of additional structural distortion and passes on the rest. After all the additional structural distortions are absorbed by the latticework-squares, subsequent latticework-squares do not feel the action of effort at all. This limits the range of direct inertial effort. It is limited within the matter-fields (of macro bodies) in direct contact. Action at a distance through empty space is an impossible proposition for two reasons. One is that there is no empty space. The second is that the range of inertial action is limited to within the matter-fields of macro bodies, which are in direct contact.

If the action of an external effort continues or its magnitude is increased, the magnitude of strain in latticework-squares of the matter-field and corresponding stress in them increase, and a few more latticework-squares of matter-field, in the direction of external effort, are deformed. The range of an inertial action corresponds to the magnitude of additional structural distortions; it may invest in the matter-field of a macrobody. On termination of external effort, no further action takes place, but the structural distortions already invested in the matter-field continue to move the macrobody at a constant linear velocity.

Additional structural deformations of latticework-squares, produced by the external effort, may be regarded as temporary work done on the macrobody. They remain with the latticework-squares until they are transferred to their neighbors. This is all the effect that a direct external effort can cause to a macrobody / its matter-field. Consequences, to this effect, like motion of macrobody, etc., are the result of reactions from the matter-fields to additional structural distortions introduced into them.

Conclusion:

Inertia is a property of the universal medium due to its latticework-structures. A certain delay is required during an action of effort (force) for the stabilization of structural distortions in the universal medium. Once, a macrobody attains its stable linear speed in space, it continues to maintain its constant state of motion. These two phenomena, together, create an observable fact that a macrobody is reluctant to change its state of motion. Although effects are observed on the macrobodies, they are caused by the reluctant action of the universal medium. Hence, inertia is a property of the universal medium rather than that of matter. The inherent character of the universal medium to strive towards absolute homogeneity is the cause of all actions and inertia.

Reference:

[1] Nainan K. Varghese, *MATTER (Re-examined)*, https://www.matterdoc.in/

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