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The complete publication and the example inertia drive info is available at www.mindbits/series/1278
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Abstract of the inertial propulsion drive
A study is presented to determine the viability of inertial propulsion and the path to fulfill the realization of the inertial propulsion method culminating in a formal mathematical proof. This Proof is extending the known proportional relationship of the angular spin frequency in relation to the straight line impulse reflections, from a full cycle to the frequency variance between 1/4 turns (π/2) of the spin. This proof has been accepted as a contribution to the 2013 WSEAS conference on Mechanical and mathematical modeling. Within the present study, frequency modulated mechanical oscillators working in the complex Cartesian grid are examined for a capacity to develop a cyclic repeating net self-contained propulsion thrust impulse force drive in a predetermined direction in correlation to 1/4 turns. Wherein net thrust impulse drive means that the net product of average force multiplied by the cycle time is larger in
the direction of a vehicular motion. Reality check quantative Pendulum Tests are available from www.mindbites.com/series/1278

FIELD OF THE PRESENTED INERTIAL PROPULSION

The main objective of this publication is to describe, in an easily digestible practical realistic format, the formulas, methods and proofs used to engineer the inertial propulsion device. In view of Einstein’s type of writings, it is presented that practical established existing mechanical construct examples, used within the publication, have an indisputable level of certainty in comparison to purely abstract physics thinking. The level of math and physics is kept at or below mid-university level. The publication represents a thorough scientific investigation comprehensible by a large general audience, school and media personnel with firm knowledge of college math and physics having a keen interest and desire to investigate new technologies and the latent historical barriers for an earlier discovery.

The presented calculations for the engineering of the propulsion device uses the units of kinetic energy in Kgfm, Joules and the N to illustrate the forces at play in easy terms, 1 kgf is simply the force 1Kg mass delivers to the ground in Paris France, which is only fractional different in the readers location and everyone buys 1 kg of potatoes, while 1 Newton force accelerates 1Kg mass to 1m/s². The Earth gravity accelerates 1Kg mass to 9.8m/s². 1Kg mass is then defined as 1Nforce*1s²/1m. The meter is conveniently reproduced with a measuring tape and the product of Kgf multiplied by the meter is the kinetic energy of 1 kgfm = 9.81 Joule (the force of 1 Kgf exerted over 1 meter distance = 9.81 Joule). Which is about the electrical energy of 0.003-Watt hour. The measure for the frequency of rotation is RPM revolution per minute and the angular velocity $\omega$ to illustrate the cycle frequency used. RPM is more commonly used in the eggbeater than angular velocity. While it might be considered old fashion to use Kgf and RPM, a technical person can appreciate N and $\omega$ while a complete layman will appreciate Kgf, RPM.


For simplicity, premier certainty and clarity the use of differential calculus
expressions of parameter instantaneous delta/delta rate of change (derivatives/slopes) are minimized, because of the uncertainty and complexity how the instantaneous localized rate of change (slope) varies within the propulsion working cycle time-frames by the applicable physics/math functions. Instead, the primary rule of the slope of the secant line, the mean value theorem is used, describing the average slope and integral of the parameters magnitude Y-axis-gain/X-axis-gain changes spanning the propulsion cycle. This principle is also commonly referred to as: “Rise over run”. The word “gain” is used to indicate the change (Gain=Rise) and is for the entire cycle and not an infinitesimal small delta. For example: Velocity, gain / time is acceleration, Velocity -gain /time is de-acceleration. The secant line rule perfectly describes the average rate of changes over the entire propulsion cycle. For example: Speed, average, m/s = Displacement, gain / Time, duration. Always: displacement is meter and time is seconds; furthermore: Force, average, N = mass * Velocity, gain / time, duration. The * is used as the multiplication operator. The average or mean value can then be used in conjunction with vector math to arrive at the final effective parameter magnitudes as is common practice in electrical engineering.

If the reader is unfamiliar with the following math concepts it is recommended to review the following References:
www.en.wikipedia.org/wiki/Mean_value_theorem
www.wikipedia.org/wiki/integral
www.ehow.com/how_4963946_calculate-average-force.html
www.en.wikipedia.org/wiki/vector_space
www.en.wikipedia.org/wiki/Feedback#In_mechanical_engineering/
For Rotational Dynamics and the Flow of Angular Momentum:
www.physikdidaktik.uni-karlsruhe.de/.../rotational-dynamics.pdf
For proof of uniform versus non-uniform angular motion:
www.farside.ph.utexas/teaching/301/lectures/node89.html

ABOUT THE AUTHOR

The author, Gottfried J. Gutsche has an education in Control Engineering, Cybernetics and Electrical Engineering applying to the electrical control of motors for inertial mass manipulation in factory automaton. In particular, attended special courses teaching machine inertial mass motion control loop stability analysis. Subsequently worked 28 years in data progressing technologies as a group team member of highly skilled computer diagnosticians. From there, the Author operated a consulting service designing automation equipment, a grand total of 50 years
The previous work experience fine-tuned the author to deliver consistent high degree of quality analysis on difficult problems relating to inertial mass manipulation within machines. The author has 1 patent, 5 patent applications.

**ASSUMPTIONS**

The processes and the methods of the present inertial propulsion systems are based on known laws of physics and therefore have the same inherent assumptions and limitations as these known laws of physics. However the assumptions of the mass motion laws are examined to determine how these assumptions are congruent with the reality of the measured operation of the presented inertial propulsion drive. In summary: The following physics laws and their inherent assumptions apply and the presented process, in its functional entirety, has been verified with experiments and working models. The presented postulations are based on the following assumptions:

- The law of continuity of physics laws within a moving platform, the law of continuity for physics principles in general.
- The laws of periodic cyclic rotational to straight line coupled mass motion reflections in the complex Cartesian rotational vector grid applying to periodic energy avalanche discharges having the root cause in the symmetry of the stored energy to the centripetal force exerted over the rotational displacement distance.
- The law of uniform proportional relationship of mass motion acceleration in relation to the force applied in uniform motion systems.
- The law of escalating kinetic energy content for the increasing velocity of mass motion.
- The law of conservation of kinetic energy and energy in general is assumed and proven, within this publication, to be the primary conservation law for rotational to straight line displacement coupled non uniform Huygens-Steiner type mass motion.
- The law of conservation of momentum, applied within straight line mass motion, for angular mass motion and for rotational to straight line coupled mass motion.
- The law of equal reciprocal reaction to the action of an impulse and its limits of validity for the cyclic combined rotational to straight line displacement coupled mass motion.
- The law of the motivation of a mass with unbalanced forces applied.

**THE FUNDAMENTAL BACKGROUND OF THE INERTIAL PROPULSION**

Physics is the study of matter, energy, space-displacement within the passage of time, how they interact in nature and the quantative reality prove of theses
interactions. Throughout this publication the physics of matter, energy, space-displacement within the passage of time, how they apply to inertial propulsion and the applicable quantative reality prove is the subject under scrutiny.

In the very beginning of mathematical and physics thinking was Archimedes statement: Give me a fixed point to stand on and I will move the Earth. This statement seems to tell us that there must always be a fixed point to move an object of substance, therefore, the notion of inertial propulsion ought be rejected by thinking only in terms of levers and pulleys. A return to Archimedes type exact analytical thinking in science was brought about by the dis-content with the iron yoke of authoritarian teachings in the Renaissance by logically investigating and proving physics principles again with incontestable exact quantitative experiments. In particular, the subject of inertial mass motion was brought into the forefront of science by a doctrine shattering experiment by Galileo. Galileo rolled cannon balls down an inclined board having equal (repetitious) spaced notches inscribed. The clicking noises made by the cannon ball hitting the equal spaced notches were having an ever shorter time interval and ever higher pitched sound indicating a non uniform temporal (time) behavior of this inclined notched board system. Accordingly, the potential energy depleted in form of dropped height was causing an exponential-accumulative increase in cannon ball speed. Galileo presented a lengthily math solution to the notched board experiment in form of a complicated word problem requiring very high disciplined thinking skills. From there, a quest developed to improve Math-Algebra tools to better describe the exponential behavior of Galileo’s experiments. Furthermore, two continental European scientist G. Leibniz and C. Huygens, with reciprocal cooperation, identified Galileo’s notched board experiment to be congruently related to the progressive performance of projectile motions hurled by machines of war delivering the progressive ability to do destructive work against castle walls. They called the exponential ability of mass motion velocity to do destructive work “Vis Viva”: The living Force contained within an inertial mass in motion. An ancient known principle. Leibniz wrote a book teaching calculus Math, to arrive at the average values exerted by these exponential systems using a set of algebraic exponent rules making cumbersome word problems unnecessary. Huygens investigated Galileos’ notched board experiment when extrapolated onto the swing of pendulums and wrote two very important papers “The Centrifuga” and “The Oscillatorium” laying the foundations of quantative rotational dynamics based on potential energies transferring into motion quantities. With these papers Huygens Invented the centrifugal force and the moment of inertia and presented congruence with Lagrangian, R. Hamiltonian and H. Hertz mechanics. Huygens and Leibniz
maintained a lively correspondence and visits discussing these principles openly in
great detail, correcting-helping each other in an amazing collegial manner without
any fear of losing intellectual property. However, the most prominent, successful and
accomplished scientist of the Renaissance was Newton. Newton had the great,
profound and far reaching idea to remove the exponential mass motion behavior by
reformulating Galileo’s notched board math word problem into uniform (repetitious)
time intervals INSTEAD of uniform distance intervals. When analyzing straight line
displacement inertial mass motion velocity in uniform (isochronous) time interval
progression, the exponential- accumulative temporal behavior, we have seen in the
displacement analysis, disappears and an uniform proportional relationship between
force and acceleration is presented. Wherein the displacement length is the area under
the motion curve, an “apparently” easily understandable correlation. The most import
advantage of this time based domain analysis is that the force is having the mean
value of a curve spanning the motion velocity-gain (amplitude) time duration. The
time based domain analysis can also be demonstrated with a declined notched board
wherein the notches are spaced progressively further apart, such that arriving at an
isochronous (monotonous) klick time intervals. Newton was then applying the time
domain analysis successfully to planetary arc motions around the sun and published
a book: “The Principia” describing in detail how a time domain analysis applies to
mass motion. Within his Principia publication Newton also presented his very
important invention of the centripetal acceleration which solves the forces applying
to an inertial mass moving in arc motions in opposite orientation to Huygens 19 years
prior invention of the centrifugal force, having each identical formulas. This is,
because, the centrifugal and centripetal force are a pair of inseparable forces in
simultaneous opposing direction, they are a force couple each does not exist without
the other. From his Principia writing and further statements it appears that Newton
regarded the discovery of the centripetal acceleration applying to planetary motions
to be his most important work. However, during rotating pendulum experiment
having simultaneous rotary motions and straight line displacement coupled
reflections, Newton encountered similar behaviors Huygens had described in his
publications in previous years. These combined motions were solved by Huygens
with his displacement based domain analysis of potential energy transferred into
(kinetic) motion energy and are not necessarily (easily?) Directly solvable with
Newton’s time based analysis of “fluxions” of impulses. Newton performed a great
leap of human intelligence and sensed therein a more complex system, calling theses
combined mass motions investigation too numerous and tedious for final analysis. To
keep his Principia uncluttered and to avoid using or referencing Huygens
publications, he did a very smart move by separating straight line displacement mass motion from the troublesome combined motion pendulum experiments and apparently let future scientist to develop better Physics tools to describe these systems. Evidently, we have here somewhat an unfinished theorem ala Fermat! Fermat ran out of paper, Newton ran out of time and patience. Newton, however, seemed to cast these pendulum experiments not only off into an uncharted area, but cast the subject off limit by a somewhat conflicting all encompassing doctrinaire pronouncement. Newton postulated his third law of mass motion by arguing that there is always an equal and opposing reaction to any mass motion action. The ALWAYS argument appears to include also Huygens combined straight line displacement to rotational motion reflections against pendulums. This is, however, un-provable because of Newton’s’ himself stated near infinite possible inter correlation- reiteration of the three possible motion directions and infinite velocity progressions of one single unit of mass: The axial rotation, the tumbling head over heels motion and the overall forward motion when interacting between multiple units of mass. Newton accordingly writes about his combined rotational to straight line displacement reflections against pendulums: “But these reflections (rotational motion reflected onto straight line displacement) I will not consider in what follows and it would be too tedious to present every and all examples of these combined motion reflections”. From these statements, it is already clear, Newton already presented us in the “Principia” the answer how Inertial propulsion can work: With rotational mass motion projected onto straight line mass motion reflections. In retrospect, in view of this “Third Law exclusion” it can be assumed, Newton already had performed an underlying un-published experiment indicating Inertial propulsion is possible. Within this publication three examples of experiments are presented proving this principle.

The basic traditional operational principle of an Inertial Propulsion is the generation of an unidirectional motivating self contained energetic force impulse (Thrust) within a vehicle, in direction of the intended motion of the vehicle. A self-contained impulse is self-contained if there are no force exertions against a fixed point external to the vehicle and the root cause of the impulse is an internal source of energy quantity. The internal source of energy quantity is the work of an internal motor force over a distance. The force impulse must be regarded as the motivating agent of the isolated system of the vehicle and is the product of force and time interval applied to the whole aggregate mass of the vehicle. The internal product of force and time must be larger in direction of the intended motion of the vehicle to propel the vehicle forward.

The presented Inertial propulsion drive is employing a Huygens-Steiner
Theorem type dynamic process using the combined effort of the two vector dimensions of the inertial reluctance contained in the mass motion of flywheels, the straight line displacement and angular (rotational) reluctance to motion within a plane. The dynamic process generates a timely sequential variable impulse mutually reciprocally exerted between the combined straight line and rotational inertial mass reluctance of a flywheel and the aggregate sum of the Vehicle mass. The cyclic dynamic process further generates three timely repetitive identical (base) initial mass motion potential energy conditions and one superior peak initial potential energy condition in a closed loop mutually reciprocal energy flow. This means, the timely sequential impulse having a superior magnitude in direction of the intended motion of the vehicle is applying Newton first law: The aggregate inertial mass of a Vehicle remains in motion until acted on by a subsequent superior opposing force impulse.

The question whether or not such a self contained motivating force impulse can exist within an isolated system of a vehicle was raised again early in the 18th century when clockmaker attempted to build clocks capable of sustaining the local time of the port of departure for longitude navigation. Here again we have Huygens’ rotational pendulum mass motion with straight line displacement reflection being employed within these clocks and Huygens was heavily involved, from the very beginning, in finding the perfect clock for ship navigation. Clockmakers were confronted by an intriguing problem: It seems, no matter how ingenious such clocks were devised they either advanced or retarded when placed on ships in comparison to the port of departure local time. This of course means; the clocks gained energy or depleted energy over time while clocks are designed to deliver very exact equal energy portions over very long time durations. It was determined that the complex motion of the ships was causing the change in clock timely energy distribution magnitudes. This principle is the theme of the endearing film “Longitude”. In this true story film, the clockmaker Jon Harrison determined that a certain motion of the ship, his clock creation was tested on, delayed his experimental test clock a relative equal amounts of time thereby saving the ship from a navigational disaster. Harrison was able to extrapolate the time delay of the clock to the changes in initial potential energy conditions of the clock pendulum swings caused by the ship motion impinging on the pendulum motions. The films story is documenting a brilliant performance of human intelligence. How can we explain such a true phenomena with Newton’s Third Law of ALWAYS equal reaction to an action? How can an action of the isolated system of a ship react on the kinetic energy of a clock contained on the same ship without direct transmission traction simply by the oscillating motion of masses? Since
the ship to clock energy transfer relationship is a documented reality, then it can be argued with accuracy: Because of the reversibility of physics principles, energy and impulse must be continuously transferable from very large clocks mounted within vehicles in a reversed process. However science dismisses such phenomena as caused by reiteration / reverberations / sticktion / friction against the surface of the earth without delivering a comprehensive physics description / quantitative-proofs of these actions in all inertial mass motion combinations. However, all presented mechanical constructs presented here do not, in any way, work by the root cause of friction. According to the presented mechanical contracts the stiction-friction argument must be redefined to be applicable to purely straight line uniform motions with small friction compliant acceleration differentials. If we need the surface of the earth as a reference source to motivate a vehicle with a self contained impulse, why is it not possible to use a second clock delivering an identical directed impulse magnitude but in a mutually opposing mass motion direction mimicking the reference source? Yes, this publication seeks to present that such a system of tandem mechanical oscillators have an unidirectional self contained impulse capability generating its own reference source. This publication’s aim is then to provide an answer to what these reiterations / reverberations / sticktions / frictions are which motivate vehicles without traction of wheels. Accordingly, in view of the ship chronometer reality without any further ado, we must already concede that inertial propulsion must be possible and patents claiming such capability must be carefully examined for individual validity. The question remains: What thrust magnitudes are possible within what type of mechanism.

The Inertial Propulsion drive motivating force impulse is a vector force, which is an applied force magnitude spanning a three dimensional direction and having a time duration. The time duration covering all functions of the isolated system at the same time-instant can be defined to be the cycle time duration (the passage of time during one complete rotational cycle). Therefore using the law of mean value, the analysis of the dynamic process can concentrate on the average force, applied to or delivered from the cyclic motion of the inertial masses over their total displacement (motion distance) and within the cycle time interval, which is the average flow of (kinetic work) energy within a time frame (flow of energy quanta within the time domain).

The flow of energy or work must be viewed as the analysis of the vehicles’ motor size and the position of the gas pedal. The kinetic energy is the energy content of a mass in motion having a measurement of 1 kilogram, force, meter, Kgfm=9.81 Joules in comparison to all other energy forms in nature.
Energy is, of course, what marks the very first step of becoming human by learning the art of lighting a fire at will. The energy quanta per time domain, the watt or Hp, is represented by the sustainable magnitude of the campfire humans maintained during the time of rest. Energy is still the most important commodity and issues facing humans today: Where can we get more energy? The flow of energy within a time domain pertains to the choice of the car engine Hp size and what energy consumption per person is politically correct?

The concept of a quantity of flowing work/kinetic energy within a time frame having a flow direction, a source and a sink, is an extension to the traditional approach of work performed within a time frame, which is in traditional view power or horsepower with the addition of flow direction. Work/Kinetic energy quantity flow is a more suitable analysis approach for the presented propulsion concept, evident from work/kinetic energy transmitted over hydraulic power lines, transmission shafts, kinetic energy absorbed by flywheels and the transport of items on a conveyor belt. In mathematical physics term kinetic energy/work flow is the delta energy/work per delta time power=de/dt.

The concept of kinetic energy flow analysis in the time domain and the force in the displacement domain (the passing of distance) and the force in the time domain (the passage of time) are used within the body of the publication to prove the directional force impulse gradient by geometric figure comparison when the vehicle is in motion and held at rest. This is because: A motor is generating mass motion kinetic energy by applying a force over a distance (force * displacement), which is the area of a geometric figure in the displacement domain. The displacement domain analysis is then a geometric figure where the base-line is a straight line representing the passage of distance and the area above the base-line and below the curve is the magnitude of the average force. In contrast: Impulse is the play of a forces within the time domain (the passage of time) which is the area of a geometric figure circumscribed by the play of forces where the passage of time is the base-line of the geometric figure and the area above the base-line and below the curve is the distanced displaced. Inertial mass motion caused by the steady acceleration is then having a straight line curve in the time domain analysis and a progressively flattening curve in the displacement domain analysis, this has been demonstrated by Galileos’ notched board experiment.

At this point, having viewed the basic principles of mass motion analysis it is important to compare the underlying physics analysis views pertaining to the displacement domain analysis and the time domain analysis. What are the underlying physics analysis of the same physics phenomena of inertial mass motion explained
in an indisputable practical format?

The displacement domain analysis is telling us that the nature of inertial mass reluctance requires a progressively larger force exerted per uniform (repetitious) distance intervals to increase the mass motion velocity an equal amount. This is because an increase of mass motion velocity instills into the inertial mass a larger ability to do work, the Vis Viva is depending on the previous speed history of the mass motion velocity. The “Vis Viva” is then:

#1) Force, average, value, N = mass*(V², new, speed-V², previous, speed)/(2 distance)

Ref: Gieck Formulas: Kinematic section L1 to L10

From this formula we can extrapolate that the early displacement POSITION, within a long motion quantity, were the maximum gain in speed per equal spaced displacement is occurring will significantly influence the sum of the FORCE mean value magnitudes and will significantly influence the average speed magnitude of the motion in respect to the total motion distance, wherein the initial potential and kinetic energy sums, and the impulse sums remains zero (0) within an isolated system. This is the Lagrangian, Hamiltonian and Third law principle. It is also very important to note three important logical points: Point #1) Formula #1 applies only to a motion exerted from a fixed point, like the earth gravitational pull. Point #2) The 2 divisor in this formula, the 2 divisor tells us that formula#1 applies to a displacement section having uniform mass motion. A uniform mass motion is a motion where the mass motion velocity increases a uniform amount for every uniform measure of time interval. Point #3) The inertial mass motion parameter magnitudes have an absolute experimentally verified validity by the Carriolis principle. Furthermore, for a uniform motion the average speed is the speed gain divided by 2. Accordingly, for a long string of concatenated mass motion sections, wherein each section is having a different speed gain per equal distance, then the average value force is the sum of all individual forces calculated with formula #1 for each section, divided by the number of sections n:

#1.1) Force, average= force,sect.1+force,sect.2+force,sect.3......./n
#1.2) average speed =average,sect.1+average,sect.2+average,sect.3.../n
#1.3) Impulse,sum=force,sect.1*(distance/speed,average,sect.1)+force,sect.2*(d....

From this displacement analysis formula a very high resolution and certainty of energy, average force and impulse can be obtained from any type of motion depending only on the number of sections used. Furthermore, from here, the isomorphic behavior of inertial mass motion speed in respect to energy can also be extrapolated. However, Inertial Propulsion is performed with a combined rotational and straight line displacement motion reflection in a non-uniform rotational motion
progression having a mutual reciprocal exertion between two inertial mass bodies without an external fixed point of exertion (Newton’s too numerous and tedious experiments) wherein the 2 divisor is applicable to both, the changing angular motion, the changing straight line displacement motion and we must apply the consideration of potential energy distribution between two bodies, a triple averaging procedure.

In contrast, the time domain analysis is telling us that a sum amount of impulse, the summed product of force and time duration, will impart an increase of proportional amount of inertial mass motion velocity independent of the time position, independent of displacement length or previous motion history pondering, as long as the motion is well below the speed of light, wherein force is assumed to be empowered to follow the inertial mass speed gain and the force is exerted from a fixed point. Then mean value Force, a mathematical construct, is:

#2) Force,mean,value,N=mass*Speed,gain,straight,line,displacement/time

To illustrate the two analysis system side by side in practical terms one has to look at the operation of the ideal race horse having its maximum speed gain at the race finish line and having weightless-mass-less-frictionless legs:

For the displacement domain we can say: The horse forages on oats which has an equivalent of energy printed on the serial box in Kcal which contains a proportional equivalent of force multiplied by displacement distance Kgfm = work, 1 kcal or 0.0023 kgfm. This means there isn’t much energy in terms of kgfm in a box of oats. The horse must moves its legs for every uniform measure of distance sections displaced by its body with a force which is depending on the previous speed of its body according to the work:

#1B) Ek=Force * distance, Kgfm = mass * (new, speed² - previous, speed² ) /2.

This means; the faster the horse runs the progressively higher is the required force per measure of uniform distance. We can conclude, the speed of the horse is limited by the magnitude of the force it can deliver over the uniform measure of distance from the quantity feed of oats it previously has received and its ability to deliver this energy to its legs. Accordingly, energy expended reaches infinity well before mass motion speed reaches infinity. This is the root of the Galileo - Leibniz-Huygens Relativity Principle, when we assume that the speed of light=c is the extreme speed limit then we have Einstein’s Relativity principle. Einstein’s relativity principles is derived from a mass motion exertion from an unmovable point, wherein the absolute speed limit c has been determined to be the speed limit of electrons motivated by unmovable (static) very high-voltage cathode-ray tube electric fields.
The absolute speed limit of an inertial propulsion system, however, must still be proven with experiments because Inertial propulsion works with self-contained impulses and are not exerted from an unmovable (static) point within an isolated system.

In contrast, for the time domain analysis we say: The horse is applying a measure of force multiplied by an uniform measure of (isochronous) time duration intervals, which is the impulse-magnitude, to its legs which motivated the body of the horse to a proportional incremental higher velocity independent of any previous velocity magnitudes and independent of any speed limits.

\[ \text{#2B Impulse, Ns} = \text{Force} \times \text{time, interval} = \text{mass} \times \text{speed, gain}. \]

In the time domain analysis it seems easy for the race horse to win the race, more impulse results in proportional more speed. But obviously, the time domain analysis does not take into account how often the horse has to move its legs per each time interval of the speed, thereby, using more and more of the force effort for moving just only its legs back and forth in ever shorter time intervals. We can say: The time domain analysis has the disadvantage of NOT having a build in description of cause and effect. What is causing the force to appear in the first place, what is causing the force to be exerted at an elevated speed and what empowers the force to follow the acceleration of the horse? Where is the potential energy causing the force to appear? While the time domain analysis provides the advantage of an uniform relationship of impulse to mass motion speed gain, it disregards the mechanical ability of the horse to deliver (the energy flow magnitude) such a mass motion impulse at a speed from a store of potential and, most importantly, it disregards that the horse having the highest average speed will win the race, if the total race speed-gain at the finish line is identical between each horse participating in the race. Accordingly: If the horse delivers a higher force per the uniform equal time intervals at the beginning of the race, while the total sum of all impulses remain constant, it has a higher chance to win the race. This, however, is not possible to extrapolate from the time domain analysis with formula\#2, but can be extrapolated from the displacement domain analysis with formula\#1, \#1.1, \#1.2. The disadvantage to co-relate the impulse to the average velocity is severely limiting the applicability of the time domain analysis. For matter of fact, the average force per time interval delivered by the race horse can not be calculated with impulse or momentum formula \#2 until the energy magnitude is known, because, the magnitude of the acceleration, the of root cause of the motion and the root cause of the race time duration, is depending on the energy expended over the race track distance:

\[ \text{#3)Acceleration, average} = \frac{\text{Energy, work, magnitude}}{\text{distance, track} \times \text{mass, horse}} \]
The relationship of energy and acceleration is a displacement domain/energy analysis, a uniform proportional relationship, double the energy magnitude will generates double the acceleration for the same mass. The acceleration/work theorem is always true no matter how the force varies over the distance because of the before mentioned mean value theorem and the conservation of energy theorem, no energy can be gained or lost. So, the conclusion is: The horse race can NOT be calculated or predicted in the time domain until the race is finished and the time duration is known because the race time duration itself is depending on the displacement domain analysis, an energy analysis. However the time domain analysis within Formula #2 can be expanded by the straight line displacement on both sides, left and right side of the formula, to arrive at:

#4) Energy, work, magnitude, \( \text{kgfm} = \text{mass, horse} \times \text{Speed, gain} \times \text{Speed, average} \)

Accordingly, energy work is directly proportional to the product of speed gain multiplied by average speed of the horse wherein the mean value of formula #2 is preserved and we got rid of the 2 divisor for the uniform motion considerations. Formula #4 has a high certainty level because it is derived from the mean values of force and it will be proven to deliver always the true absolute minimum value of work performed and energy expended. The logic of formula #4 seems to suggest the possibility that a steady cyclic repeating speed gain amplitude and a variable average speed per race track distance in a straight line displacement mass motion can produce a directional difference in impulse magnitudes when comparing two directional opposing horse races. The difference in impulse will be analyzed with a two conveyor belt system and proven to be correct. However, further analysis proves also, purely straight line displacement systems, working with an indivisible conveyor type mass combinations, do not and cannot produce a working inertial propulsion system as correctly postulated by Newton’s Third Law. This postulation will be again analyzed with reiterations of variable mass motion combinations when considering mutual reciprocal straight line motions on a frictionless surface and will be found to be also true. This limitation is applying to purely straight line displacement motion of the horse race, it can also be extrapolated by analyzing the finish-line photos of a horse race. Consecutive photos taken at the finish line will show that the speed of all horses are in most cases identical. This means the momentum of each horse is having an identical momentum when we assume that the mass of each horse is identical. Accordingly, each race horse received an identical sum of impulses. This now seems a paradox as each horse is showing, in the photos, a different distance to the finish line. Yes, here we must again point to the difference in analytical capabilities of displacement domain analysis versus to time based analysis. Furthermore, in case the
most eager horse in the race is attempting to accelerate a few seconds before entering
the finish line and actually manages to move up in position only 1 cm short of an
equal position with the lead horse. Then we can say: The eager horse has performed
a higher impulse sum and has acquired a higher momentum as the lead horse but is
still in not winning the race. This is of cause, because the eager horse needs an
advantage in acceleration to catch up with the lead horse position, then displacement
multiplied by acceleration is an energy consideration. Then we can postulate:
Comparative, mass motions having equal position and equal time durations can have
unequal impulse - momentums. This what we are trying to accomplish, unequal
impulse and momentum within one repeating cycle.

The time base analysis does not provide us with a practical way to answer any
distance questions related to time, or allows us to formulate a practical winning
strategy based on stop watch readings before the race has started. Only when applying
involved integration of all the instant speeds, after the race is finished, we can
correlate the sum of all the instant speeds to the horse position per time. This
integration can not be performed before the race because the progression of the
racehorse speeds -accelerations are unpredictable. However, such a velocity
integration is actually a displacement domain analysis in disguise, because the
distance, delta = speed, average, per delta * delta time, wherein the sum of all the
delta distances is the total. Then the total distance \( s = V \), average * t, total.
Accordingly, the usually presented \( s = vt \) pertains only to one steady speed and
\( s = (v_1 + v_2) t/2 \) applies to uniform accelerations. Furthermore, The integral of impulses
can not provide us, in any way, with an answer to race horse position at a time
duration, it only provides us with a momentum magnitude. In contrast, the
displacement domain analysis of formula #1, #1.1, #1.2 provides us with a position
analysis of each race horse with the possibility to extrapolate to a minimal race time
duration by co-relating the potential energy to work magnitudes to the average speed
per race track distance markers. This, accordingly, presents the highest efficiency of
thought for isolated system machine inertial mass motions. This is how Christiaan
Huygens solved his pendulum problems between anno 1659-1673 up to 14 years prior
the publication of Newtons’ Principia. However, did Huygens know about the
impulse to momentum limitation, and importantly, did he need to know the impulse
to momentum relationship to solve his oscillation problems? Yes, he knew about the
impulse to momentum correlation which he helped to formulate with Lagrange. No,
but he choose formulas #1, #1.1, #1.2, #1B and was successful doing so. And from
these points of initial analysis we can postulate already with certainty: Machinery like
the Race Horse, the Indy 500 Car racer, the Inertial Propulsion or any other
machinery, where position in relation to time progression occurs, must be analyzed first in the displacement domain. Because, it is not practical possible to extrapolate the sum of impulses and the resulting momentum to the initial mechanical energy root cause of the motion and vice versa. Machinery internal inertial mass motion is an energy management problem, while the impulses are the reflections of the momentums. Here we arrive at the first important postulation for machines:

The initial root cause of inertial mass motion within machines is the exertion of a work quantity from a quantity of potential energy at each displacement positions, causing a gain in speed for each change in position, causing an accumulative average speed at each position in relation to the initial starting position, causing an accumulative total momentum and causing the total motion time duration over the total accumulated displacement distance.

Accordingly, when someone maintains that all inertial mass motion problems are solvable with formula #2, without any actual real displacement length parameter considerations, we surly entitled to say: You surly are disregarding the practical reality of energy conservation within machines, the Lagrangian and Hamiltonian principle. This principle will be proven to final exhaustion with many examples.

To complete the range of analysis by including all possible changes in variables we must include also the analysis in the frequency domain, the play of forces in relation to a change in cycle frequency. Because the presented IP system works with the variations in cycle frequency.

Reference: www.physics.int/motion-graphs/

However, all four methods of analysis are important depending on the physical environment the Inertial Propulsion vehicle is in. While a vehicle is within an intense gravitational field, the analysis must be in the time domain, because the vehicle is not moving, the play of forces are only countering the gravitational force (hovering) and all kinetic energy flow quanta is being recycled within the vehicle. Thereby one can postulate that the generated force holding the vehicle in the hovering position is a net ZERO energy consumption because of ZERO MOTION of the vehicle, except friction and efficiency losses of the moving Internal inertia elements. When the vehicle is in a relative low gravitational field, then the analysis must be in the displacement domain and in the time domain, because the vehicle is moving and is performing work against the force of gravity at the same time. Thereby the vehicle is displacing for each quanta of kinetic energy per time frame (per operational cycle) and therefore the aggregate sum of the vehicles’ masses is absorbing kinetic energy. This very important principle and its foundations are proven in the body of the publication. The exception to this simple rule is the consideration of the thrust timing.
each cyclic dynamic process per vector dimension of inertial mass motion is delivering. This consideration has to be entered into the analysis. If the effective trust timing is less then continuous, having time gaps, then, there is a flow of energy between vertical (perpendicular opposed to the gravitational pull) potential energy and vertical kinetic of the vehicle, a sort of vertical vibration. This vertical cyclic vertical vibration of the vehicle consumes energy. A sort of continuously kicking a ball up a steep hill. How this kicking the vehicle up a steep hill, or a suspension from a pendulum affect inertial propulsion and the breakeven energy consumption magnitude, will be proven in the body of this publication.

The flow of kinetic energy example: The flow of quantities of kinetic energy for different masses being accelerated and transported in one single vector dimension by a horizontal level conveyor belt disregarding friction losses follows:

Power, flow, magnitude, Kw,Hp=mass * Velocity, conveyor, belt * acceleration
Since Acceleration is = Velocity, conveyor, belt / Time, acceleration, duration
Power, flow, magnitude, Kw,Hp=mass*Velocity, conveyor, belt/ Time, duration

Because: Power, flow, average, Kw, Hp = Force, average * Velocity, average
The above formula describes an universal principle in Physics applying to any reluctance delay process. For example: The presented formula reoccurs in the electric capacitor energy flow as:

**Power, flow, magnitude, Watt = Capacitance * Voltage² * 2 * π / Time, cycle**

Capacitance is comparable to mass and voltage potential is comparable to mass velocity potential. The time duration depends on the electrical current supply capacity (energy flow capacity) of the capacitor charging circuit which is the equivalent of the conveyor belt drive capacity. Each Physics principle is known to have symmetries in other Physics domains.

The kinetic energy flow of the conveyor starts at the drive motor and the kinetic energy is released when each moving quantity of mass leaves the conveyor belt, with the kinetic energy quantity reflected by the conveyor velocity. The “acceleration” part of the formula depends on the time it takes for the items dropped onto the belt to reach the same velocity as the belt. The acceleration, which is a function of the slippage on the belt and the ability of the drive motor to maintain a constant belt speed, dictates how many items can be placed on the belt one by one in a tight spacing and therefore the total mass being transported per time interval. The frequency of items transported, the quantity of items transported per time domain, is then a function of the acceleration, which is the principle employed by the presented inertial drive. Furthermore, a decrease in acceleration time increases the quantity of
force impulses per time domain and therefore increases the mechanisms recoil impulse.

The interdependency of cycle frequency, energy flow and impulse is therefore the same for all physics cyclic flow phenomena where amplitude of the flow is constant but the cycle frequency is variable. For example: Let us drop a new item onto the conveyor belt one by one and compare a sticky belt having an acceleration time of 0.3 seconds with a slippery belt having an acceleration time of 0.6 second, then the impulse differential, frequency and recoil between the sticky and the slippery belt is double as large. Thereby, kinetic energy flow must be regarded as having a direction, having a source and a sink. Where the kinetic energy source is the drive motor and the energy sink is the velocity of the mass of each item transported per time interval.

This publication accordingly postulates: The kinetic energy flow is therefore identical to the flow characteristics of all other flow phenomena in physics, as in thermodynamics, aerodynamics, electro dynamics, radiation dynamics etc. and cannot be isolated as having separate fundamental physics laws. This is the fundamental principle in Heinrich Hertz’s book “Mechanics presented in a new Form” This means the devices found in electrodynamics generating great avalanches of energy must be available also in inertial mass motion, in particular in combined rotational and straight line displacement motion.

For a further example: if we repeatedly charge and dis-charge an electrical capacitor to a set magnitude of voltage in 0.3 seconds instead of 0.6 seconds then the energy flow, in Watt will be double as large. The contention that inertial propulsion does not work because faster does not mean more impulse is therefore incongruent because higher frequency produces indeed larger kinetic energy flow intensity and consequently a larger impulse intensity within cycling machinery. These symmetric relationships was explored by Heinrich Hertz in his book “Mechanics presented in a new Form”. Which proves that even complex Cartesian grid numbers, irrational numbers, must exist in rotational mass motions. However, obviously, the operation of the straight line conveyor cannot yet be regarded as a suitable candidate to implement inertial propulsion, because of the directional congregation of items, if two conveyors having gradient belt accelerations operate in tandem opposite directions. This negative aspect of the straight line conveyor is then Newton’s equal reaction to an action because each acceleration time frame also contains the equal reactive collision impulses of the congregated items. The question is: Is the straight line conveyor congregation of items an universal principle in Physics or is the coupling of rotational with straight line motion a mechanical arrangement sidestepping
Newton’s reaction law, the mechanical clocks on ships suggests there is.

The work/kinetic energy flow is a time domain analysis because we analyze the magnitude of energy flow per passage of time. Work/Kinetic energy flow further generates the magnitude of the recoil impulse. The operation of the conveyor clearly demonstrates the existence of the relationship of the scalar energy flow magnitude to the impulse magnitude applied to a mass and the machine generated vector direction of the generated impulse applied to one vector dimension of mass motion, which is an isomorphic symmetry. Work/Kinetic energy flow analysis thereby sidesteps the unnecessary redundant analysis complexity of work performed by the motor and the impulse applied to the mass and simply converts electrical energy flow into mass motion energy flow. We send +Kilo-watt into an isolated system and get a gain in +Kg-force-meter or +Joules or +Kilo-calories out. Any valid IP system formula must therefore be based on the energy flow principle.

In view of the conveyor belt operational formula this publication therefore postulates with certainty: The continuing repetitive cyclic acceleration of items dropped onto the conveyor belt is generating a continuous average energy flow and a continuous average recoil magnitude of the mechanism depending on BOTH, the magnitude of the conveyor belt velocity AND, OR, EITHER the acceleration time duration of each item transported. The steady average recoil magnitude is the consequence of the continually concatenating acceleration timing pulse durations. The timing pulse durations are a design criteria and are the cause effecting the magnitude of the work/energy flow magnitude. Therefore, an isolated system of two conveyors working back to back in tandem, each having identical belt velocities and gradient acceleration times will generate collision impulses against the boundary of the isolated system for items accumulating at the end of the faster conveyor. The different recoil magnitude of each conveyor minus the collision impulses of the accumulating items represents a net impulse, within such a straight line isolated system, of zero. Clearly, the analysis of the straight line conveyor illustrates the need to use energy flow capacity for the correct analysis of a system having seamlessly repeating cyclic motions, because, only the internal energy flow capacity is the root cause of the motion and is accordingly determining the cyclic time durations of such a system. A higher energy flow capacity in Kwatt or Hp will generate a shorter cycle time duration and in contrast a shorter cycle time will generate a higher energy flow. While in contrast, in traditional single vector, single impulse mass motion Newtonian mechanics, the impulse is only depending on the velocity gain of a particle, Impulse = mass * Velocity, gain. The time duration of the velocity gain is for the single shot-put mass motion impulse indeed contained within the impulse. In contrast, the
seamlessly repeating mass motion having an invariable cyclic repeating velocity gain, the average recoil is depending only on the mass motion acceleration time duration. Time duration of the cyclic repeating mass motion is indeed the only relevant parameter because the velocity gain is constantly repeating. This important dual nature of mass motion in either the single vector, single particle, single velocity gain, single shot-put impulse and the seamlessly repeating cyclic mass motion work/kinetic energy flow illustrates the importance to carefully analyze each system for the cause and the effect produced. However, ALL our important modern civilized innovations / discoveries are based on cyclic repeating mass motion or cyclic repeating motion of electrons or photons. We can say impulse “P” is a proportional function of frequency. Which important modern innovation is based on the single shot-put impulse mass motion? This relationship came as a huge surprise when Einstein explained the photo-voltaic effect with the proportional relationship of impulse to cycle frequency of light within invariable light amplitudes. Again, this is a fundamental principle in Physics clear across all disciplines.

A further example of flowing work/kinetic energy is the large flywheel mounted on a DC motor-generator shaft. The mechanical/kinetic energy developed by the motor pertaining to formula #1B is flowing into and accumulating into the flywheel mass in form of angular velocity magnitude of the mass. When the motor-generator is switched to generator mode, the stored kinetic energy (potential kinetic energy) contained within the flywheel is flowing back from the flywheel into the output of the generator. This mechanical arrangement clearly demonstrates the reversible flow, the conservation and proportional relationships of kinetic energy onto mechanical energy having a flow direction, a source and a sink. This arrangement also validates the practicality of Huygens method of using formula #1, #1.1-#1B for mechanical machines wherein oscillations are present. Furthermore, this arrangement is also used by the presented IP device. In view of the electro- magnetic-dynamics of the DC motor -generator, is it more professional, valid, advantages or economic in thought to use electrical current flow instead of the root cause input energy flow? Wherein the current flow is proportional to the torque of the motor, is proportional to the acceleration of the flywheel and the voltage potential is proportional to the final angular speed of the flywheel by the cancellation of the inherent rotating vectors! No, this is not necessarily providing us economy of thought because we are then having the race horse assumption: Electrical Current alone does NOT describe what is making the torque follow the flywheel angular acceleration! The current flow time duration and the current flow average magnitudes are both interdependent on the energy storage capacity of the flywheel, the current supply
magnitude potential and the current impedance of the motor-generator wherein the angular speed of the flywheel * torque = energy flow, VA and the voltage potential is the only prime root cause having two possible variable (manipulate-able) parameters: Voltage potential and the total circuit resistance including the circuit reactance, wherein the average energy flow, VA = Voltage², potential / (total electrical Impedance Z). The system as a whole is based on the feedback principles of energy, wherein the balance of the potential energies are pinching off the current flow, like the Toilet-Tank control. The current approx. magnitude average therein is: I=Circuit voltage potential / (total Impedance Z) and the time duration to reach balance of potential energies is: t= flywheel capacity, Ws / (voltage, potential * current, VA). Accordingly, the time duration is a complex function of the flywheel moment of inertia * Impedance, which is congruent with a dampened spring oscillator. Here again is the vis viva principle of formula#1 and one has to consequently laudable present that kinetic energy work, VA (Volt*Ampere), is the underlying principle describing the true technical potential of this system. The kinetic energy storage capacity of the flywheel is ideally suited for the temporary storage of kinetic energy because of the exponential energy content in relation to the flywheels’ angular velocity magnitude, angular motion and angular momentum. Is it possible to extract every bit of kinetic energy stored into the flywheel back into the electrical energy supply connected to the generator? Of course, all physics processes are reversible, but it requires a complicated arrangement of electrical switching apparatus, which is in mechanical terms an infinite ratio progressive variable transmission or a mechanical transmission working with step displacements repeating in very fast cycles. Such a transmission arrangement is like sipping an espresso coffee directly from an espresso machine in very small quantities: A very energetic experience in very small steps, a machine working with quantum physics. Is friction in any form, flywheel bearing friction, air friction or carriage rolling friction a consideration to described the working physics of such a machine? No, without friction the flywheel storage would never need recharging because kinetic energy can be recycled by regenerative breaking. Friction is consuming the flywheel stored energy. Flywheel physics again demonstrates the relationship of energy to impulse. Has the flywheel energy storage been used successfully for motivating vehicles? Yes, of course, the first successful use was for a public transportation bus called the “Gyrobus” engineered by the Swiss Orlekon company and the technology is being contiguously improved for energy storage systems.

The concept of motivating a vehicle with kinetic energy obtained from the store of angular mass momentum contained within a flywheel brings up a centrally
important question, is kinetic energy or momentum, the product of inertial mass multiplied by velocity, a correct analysis for such a system? Engineers will automatically resort to kinetic energy flow because the scalar magnitude of kinetic energy per time interval in Kwatt represents the physical quantity the motor-generator delivers in the first place, and if needed, kinetic energy can be calculated into a vector impulse or momentum quantity later using the isomorphic symmetry of energy and momentum.

Science courses like to use momentum because momentum is also an universally important conserved physical quantity during inertial mass collisions, as demonstrated with simple physics demonstrations using the collision of carts. The sum of all the carts’ momentums remains constant during their collision time interval. In contrast, the very practical reason engineers use the flywheel for the Gyrobus is the exponential kinetic energy storage capacity in respect to the angular velocity of the flywheel, a few more very high ++3000 flywheel RPM squeezes out 50 more acceleration-trips at the so much lower bus speed limit of 50 Km/h. How to qualify the Gyrobus in view of the momentum gained by the bus and the rotating tangential vector momentum sum lost by the flywheel, a proportional relationship in respect to the flywheel tangential vector momentum sum???!!! The scalar value of flywheel momentum loss in comparison to Gyrobus gained scalar momentum gain is a grand total of only TWO trip accelerations!!?? Is the removal of momentum from the flywheel and bestowing momentum into the bus through the path of a transmission a form of collision?? Is the sum of momentums of the flywheel and the bus constant for such a large momentum differential???. NO, the scalar sum of momentums at such a large momentum / impulse / velocity / torque differential is not constant. Who is correct here?? The answer is obvious, because, the Gyrobus performed exactly the way the engineers calculated using kinetic energy flow. That’s why the presented inertial propulsion works, because it works with mass motion kinetic energy flow through transmissions and not direct momentum conserving collisions of masses.

To illustrate again the profound difference between impulse/momentum and kinetic energy flow lets work out a simplified algebraic example:

Using Impulse/momentum only 2 trip start accelerations are possible:

\[1000(\text{mass, flywheel}) \times 3000(\text{Velocity, flywheel}) - 2\text{trip} \times (30000(\text{mass, buss}) \times 50(\text{Velocity, buss})) = \text{ZERO}\]

When using formula #1B, pertaining to kinetic energy, 50 trip start accelerations are possible. The velocity/torque differential between the flywheel and the inertial propulsion devices’ aggregate sum of masses’ is too large to make it correlate to rotating vector momentum, impulse and collision, therefore:

**NO ISSUES OF THE CONSERVATION OF MOMENTUM APPLIES FOR**
MACHINES WORKING ENTIRELY IN THE DISPLACEMENT DOMAIN, only scalar value conservation of kinetic energy applies. Accordingly: In view of the engineering reality of the Gyrobus, this publication reiterates the limitations placed on the conservation of momentum law within most good Physics books and expands the limitations with certainty by postulating:

Momentum is conserved for the time duration of a direct collision impulse of point size masses. The scalar value of momentum is not conserved for the time duration of a collision of masses having a large differential of momentum when the impulse is transmitted through a complex transmission mechanism converting velocity and torque, then momentum is translated according the conservation of kinetic energy law which is the square root out of the sum of exponential polynomials. This principle can be further postulated as: Mass motion kinetic energy transactions through transmissions are the root cause and are the prime motivating agent while impulse magnitudes follow in an isomorphic symmetry. Accordingly, within isolated system the Lagrangian and Hamiltonian principles apply:

**Potential Energy is primary while impulse - momentum follows the energy transaction.**

The author was unable to determine the rational for postulating that momentum is ALWAYS conserved, as it applies with certainty only to direct vector collisions of inertial masses, it cannot mean the scalar magnitude of the vector applying to the momentum is conserved in complex systems of transmission ratios, as applying to the Gyrobus and applying to inertial propulsion mechanisms. However, it can be postulated, with certainty, that the sum of energies, in its varied forms and in vector sums of transmission ratios, is always conserved.

The presented combined straight line displacement and rotational motion inertial propulsion, uses the two before mentioned vector dimensions of mass motions, the rotational and straight line mass motion. Thereby, two kinetic energy streams of these two inertial mass motions are working, side by side in an undulating energy conserving flow, inside the propulsion mechanism. Therefore one resultant reciprocal (reactive) motion of the propulsion vehicle.

The kinetic energy required to motivate a body of mass is transmitted by the force impulse. In case of the conveyor, the tension on the belt is the force. When the tension on the belt is multiplied by the time duration of one complete belt cycle it becomes the force impulse per belt cycle time. Therefore considering the conveyor with the ability to transport variable amount of mass depending on the belt friction, this publication postulate with certainty: Work/Kinetic energy flow per time interval can be mathematically extrapolated to the magnitude of a repeating force impulse
applied to a defined size of mass per time interval. Therefore this publication postulates with certainty:

A scalar Work/kinetic energy quantity generates a defined scalar impulse intensity on a defined quantity of mass by isomorphic symmetry. The scalar impulse quantity is converted into a vector Impulse by the vector geometric guidance of a mechanism.

The guidance of a mechanism is an universal property of physics evident in mass motion as well as in electrodynamics, thermodynamics and in radiation where diodes and mirrors can provide energy with direction. The kinetic energy stored into the body of a mass, as the result of a force impulse, is the momentum contained within the body of mass. The momentum is the product of velocity multiplied by the body’s mass.

The incremental kinetic energy content of a mass, energy gained as the result of the force impulse and expended from the store of potential energy available within the vehicle, is measured in Nm, J, Kgfm, kwh, kcalh and horse power hour. The energy quantity is in all cases the same real energy originating from the potential energy stored within the vehicle. Every reader of this publication can relate to the kwh consumed on the electric bill. But why are we billed in kwh(energy) instead of kgfh (impulse) ??? Because an eggbeater takes four times the energy to deliver twice the rotational impulse!!! Because of the isomorphic symmetry of impulse to energy, work:

#5) Energy, work, Kgfm = impulse² / 2 * mass

Therefore:

#6) Impulse, Ns = (2 * mass * Energy, work)

The Electricity utility would go bankrupt delivering four times the quantity in fuel and bill double amount in Kg force hours, the impulse magnitude in relation to 1 kg mass motion.

The relationship of impulse and momentum to the directional flow of kinetic energy applying to the two vector dimension of mass motion within a plane is, of course, the most important aspect of the inertial propulsion and, by far, the most often applied formula for machine design. Thereby, the very most basic principle is therefore the end result of the inertial propulsion force impulse process, which must be the transfer of a portion of the stored potential energy contained within the vehicle into one preferred direction of the whole combined mass of the vehicle. The transfer of kinetic energy into the whole isolated system of the vehicle has the result of the desired directional velocity gain of the vehicle, the resultant motion of the vehicle and is the energy consumption-factor per internal self-contained impulse of the vehicle.
If we now combine the formula for average Energy, work #4 with the impulse formula #6 then we arrive at the relationship of impulse to speed gain and speed average which are each mean values of the energetic effort:

\[ \text{Impulse, } Ns = \frac{\text{mass}}{2 \times \text{speed gain} \times \text{speed average}} \]

Formula #7 indicates that the total impulse is the diminishing returns relationship of the average speed when the cyclic repeating displacement speed gain amplitude is in-variable repeating. From here, it is already possible to extrapolate the proportional relationship of spin angular frequency (a measure of rotational distance per cycle time) to impulse and that a self contained impulse within an uniform repeating displacement length magnitude reciprocal straight-line cycling system might be possible? But we have also seen from the conveyor example it is impossible. Do we have a paradox because of an analysis incongruence? The incongruence has to do with the 2 modifier in formula #7. The above formula is guaranteed to deliver the true (net) effective impulse only if the speed average is 1/2 of the speed gain amplitude, which is then applying to an uniform progression straight line displacement motion. This is why we find the statement: Only applicable to uniform straight line displacement motion progression all over Physics Books. However, the impulse magnitude returned by formula #7 is less than what is being measured with a load sensors, digital integrator and a scope within a rotational to straight line displacement inertial mass motion. This is because the impulse returned by #7 employing the square root out of 2 modifier, the root mean square, and must be regarded as the minimum real (net) effective impulse magnitude without rotational coupled motions. So, we must further analyze what Newton meant with his too tedious to analyze all possible combination of rotational to straight line displacement coupled motions reflections statement.

A further fundamental principle of inertial propulsion is the distribution of an initial condition potential kinetic energy between two unequal bodies of mass having a simultaneous mutually reciprocally unimpeded separating motion caused by the power of one single source of potential kinetic energy. The whole assembly of all the parts of the vehicle is the lager mass, the straight-line (cyclic back and forth) moving inertia element (the flywheel assembly) within the vehicle is the smaller mass. However, it is important to already note: There are two energy distribution motions and two energy collecting motions having unequal initial potential energy states within one complete IP cycle applying to combined rotational to straight-line displacement coupled motions reflections. The impulse is accordingly a difference of average velocities and regular repeating base velocity amplitudes applying to formula #7.
For example: Two **UNEQUAL** bodies of mass are simultaneously mutually reciprocally separating by the force of one single compression spring being guided by a frictionless mechanical arrangement in one vector dimension of motion. WHAT is the RATIO of the kinetic energy bestowed onto each inertial mass at the end of the separation? This question has four (4) unknown parameters: 1) and 2) The two magnitudes of the velocity gain of each mass, 3) the time duration of the reciprocal acceleration and 4) the individual displacement distance of each mass acceleration. Of course, we know that impulse, the product of the spring force contact TIME multiplied by the force magnitude, MUST be equally applied to each body of mass, but we don’t know the time duration and therefore the **MAGNITUDE** of EQUAL reciprocal MOMENTUM of the two masses derived from one single source of potential mechanical energy and thereby the kinetic energy distribution RATIO, because we **do not know the time duration** of the force applied nor the velocities of each mass nor each individual acceleration distance?!

The potential mechanical energy to kinetic energy distribution RATIO is:

**THE INVERSE RATIO OF THE SEPARATING MASSES.**

In algebraic form:

#8) Energy, kinetic, large, Mass / energy, kinetic, small, mass = mass, small / Mass, large

The smaller mass receives the larger amount of kinetic energy.

**Proof:**

The total energy of the system is constant and accordingly is:

Energy, total = Energy, kinetic, large, Mass + energy, kinetic, small, mass

Therefore: By combining all three formulas we arrive at

Energy, kinetic, small, mass = Total Energy / ((mass, small / Mass, Large) +1)

This is a feedback system formula, where the ratio of the separating masses is the open loop transfer function. Furthermore:

The product of mass and kinetic energy is equal for each separating mass.

The product of kinetic energy and mass must be viewed as mechanical kinetic energy momentum of mass.

The Mechanical Kinetic Energy Momentum gain is equal for the separating masses.

Thereby: By introducing the definition of kinetic energy = \( E = \frac{1}{2} m \cdot V^2 \),

The product of mass and velocity is equal for each separating mass, which is Newton’s momentum.

And further: Therefore because: Force, average = mass \( \cdot \) acceleration

The product of mass and velocity is equal to the product of Force in the time duration,
which is IMPULSE. And further:
The product of mass and acceleration is equal for each separating mass.
The product of mass and acceleration is average Force. The Force is equally applied to each mass.
The total center of combined mass, the CM, is stationary in relation to the opposing motions.
This Theorem holds true for uniform force and for a non-uniform force applying to each displacement distance increment, because this holds true for every minuscule delta time of the mutual separation!
The special case of the mutual reciprocal separation of a straight line inertial mass motion separating the by the stored mechanical energy of a spring between a fixed axis rotational moment of inertia flywheel is:
**The ratio of the rotational moment of inertia to the straight line inertial mass times the squared radius is the reverse ratio of the kinetic energies impressed onto each part:**
\[ m * r^2 / I = e, \text{ rotational } / e, \text{ straight line} \]
For Validity Proof Ref. UCSD department of physics course web pages.

This is a fundamental principle which must be further expanded to a compound feedback system for the presented inertial drive system having an internal straight line displace - able flywheel axis. The author is unable to determine who or when the mechanical to kinetic energy distribution ratio was discovered or first used. Newton did not use the term ENERGY or the play of forces in the displacement domain nor do we know how Newton would have solved this problem with his laws without the formal kinetic energy-work theorem. The concept, however, could be extrapolated from Huygens’ “Oscillatorium” paper and is taught always in calculations when the root cause of an inertial mass motion is a potential mechanical energy source. Importantly, the potential mechanical energy source can be a compressed spring and also a spinning flywheel supplying mechanical energy through a transmission. Then the need arises to correlate the potential mechanical energy of the flywheel to the resultant impulse. Accordingly, we have to ask: Why is the energy distribution feedback flow ratio concept not included in our physics books? Why do we learn these relationships through sample problems instead of a formal stated law? Why do we have to first use Newton’s equal momentum - impulse relationship first? Then expand the impulse to mechanical energy momentum. While in reality, it is a mechanical energy distribution feedback relationship in the first place and it was in fact invented before equal reciprocal impulse. Then this publication postulates with
certainty:

From the presented principles of mutual separation of unequal inertial masses and flywheel Physics, the distribution flow of mechanical energy on the bases of the reverse ratio of the inertial mass motion magnitudes within a feedback loop is the underlying mass motion Physics Principle standing on its own far reaching Physics Principle. It is, in fact, Newton’s unfinished theorem.

While Huygens Oscillatorium paper was still largely based on geometric constructs, however, it provided displacement based analysis shortcuts to solve the pendulum problems of clock escapements not directly taught in to-days Physics books?

The kinetic energy distribution ratio has the consequence that the body with double the mass receives 1/3 (which is less) of the total potential energy of the compressed spring and the body with ½ the mass will receive 2/3 (which is more) of the total potential energy. That the energy distribution process is a feedback system should come at no surprise, as so many systems are feedback systems, from H. Hertz’s electrodynamics, Darwin’s Biology to the collapse of the stock market, all are attributed to be working with feedback systems. IMPORTANTLY!! Kinetic energy, however, was a 100 years later discovery by Lord Kelvin. The example of solving the separation of two unequal bodies of mass separating by one single source of potential mechanical energy is a displacement domain analysis, the play of forces in respect to the displacement of the masses. The mutual separation of bodies are invariable presented in Physics textbooks between two equal bodies on skates. So, now lets do an example of a group of four equal 50Kg skaters skating within an isolates system within an ice-rink. Three of the four skaters jointly push one skater away with a work-energy of 40N*meter. Then, the one pushed single skater receives a kinetic energy of 30N*meter or +55 N*seconds momentum and the group of three joint pushing skaters receive EACH 3.33 N*meter kinetic energy or -18.33 N*second momentum each, this adds up to 10N*meter total kinetic energy or -55N*seconds total equal momentum for the joint group of three. Is it valid to assign a sign to the energy of the skaters? Not really, because only the momentum vector has a positive or negative sign depending on the direction of the motion. If the remaining group of joint three skaters now jointly push away one skater, opposite, with a work-energy of 20N*meter then the single pushed skater receives the second time 3.33N*meter kinetic energy or -18.33 N*second momentum, this adds up -18.33, -36 to a total of -55N*seconds of total negative momentum vector negating the positive momentum of the first pushed skater to zero. The remaining group of two skaters receive +6.66N*meter total kinetic...
energy or +3.33N*meter for each skater. The sum of momentums of the two joint skaters at the end of the second push is +36.5N*seconds opposite a vector of -2*18.33 = 36.5 N*seconds = ZERO net momentum at end of all pushes??!!! Do we have a Physics paradox? Is energy being destroyed? Why is 40N*meter opposing 20N*meter =ZERO MOMENTUM? This is because mechanical energy is redistributed into two equal opposing 30N*meter magnitudes and this is Newton’s unfinished Theorem. Energy and impulse within straight line motions is always conserved by energy redistribution! However, the energy redistribution aspect will be used within rotational dynamics to accomplish IP. Is this addition and subtraction of opposing vector momentums derived from the isomorphic symmetry of work-energy in formula #6 valid? Yes, we have to look for an energy absorbing collisions of 2*30N*meter against the rink boards at the end of this exercise. Energy absorption is valid within energy analysis, even applicable in the special relativity case, because this is the principle of the Physics of inertial mass motions performing on a moving platform which always must return identical results as performed on a stationary platform. Furthermore: It is important the system of two mutually reciprocal mass motion separation from a single source of energy is a negative feedback problem in disguise which will become apparent when the presented formulas are solved for the energy distributed into the total vehicle mass which is the larger mass in the formula, receiving the smaller energy portion.

Here we have it again, as seen with the conveyor, employing reiterations of only straight line displacement motions can’t provide us with IP. This is what Newton already told us with his straight line reflections of rotational mass motion. Let’s consider a balanced matched group of 3 skaters and a group of 2 skaters. Each group using a ridged tether to maintain skating in opposing pre-determined ex-centric circles, wherein the group of two skaters have a larger circle to clear the group of three. If we cause a mutual energy absorbing collision between the two groups such that we anticipate the shifting of the group of three CM being equal to the circles ex-centricity when only one skater of the group of three to slide off free in a rotational tangential vector direction. Then we will find, it is possible, that 2 minus 2 skater collided kinetic energy, angular momentum and centrifugal forces are absorbed-collapsed to zero, except, the one free tangential vector momentum is unimpeded and conserved. The issue of a rest torque being applied onto the rink ice is cleared by a second mirror image simultaneous experiment. The issue of energy absorption is well solved with energy absorbing rubber band technology having an exact stress break point. This, is then, how inertial propulsion is physical possible! It is Newton’s unfinished Theorem.
The scientific investigation of kinetic energy was urged along by the emergence of the steam power technologies, in particular, the invention of the flywheel used as a temporary kinetic energy storage device. Is it possible to solve the compressed spring expansion problem or any other problem involving stored potential energy without using the work, force times distance, expended to compress the spring? Is it possible to use impulse, momentum, and equal reaction to an action or acceleration, the play of forces in the time domain alone? NO SORRY, impulse can only be stored as mass motion momentum, because the passage of time quantity disappears into history. Only work/energy, which is force times distance, can be truly stored, accumulated, compared to other forms of energy and reconstituted into impulse. Which was proven with certainty using the Gyrobus example. Therefore, the statement of “EVERY or is it ALWAYS?” in Sir Newton’s third law must be carefully examined and is in most good physics books restricted to objects of very small dimensions (point mass) motivated by the exact coincident of single shot-put vector forces and therefore can not to be extrapolated to mean exactly the same as the vector sum RECOIL of a complex mechanism working with the principle of kinetic energy transaction like the Gyrobus or the presented IP drive. Because, even the very most basic principle of inertial propulsion can not be solved or calculated or described with Newton’s impulse, momentum, reactions and accelerations in the time domain alone, IP requires FOREMOST work and kinetic energy of the two vector dimension of mass motion in the displacement domain, the scientific work of Lord Kelvin and defined as a quantity by Gustave Carioles. G. Carioles established the relationship of mass motion kinetic energy and energy of friction heat and found with accurate experiments that friction heat energy magnitude has the equivalent of \( \frac{1}{2} \) mass \( \times \) velocity\(^2\), gain. The \( \frac{1}{2} \) is trying to tell us that inertial mass motion progresses in uniform time based increments in correlation to the gain in friction heat energy, wherein the impulse is calculated with formula #6. This seems to reinforce that straight line displacement mass motion can not perform Inertial Propulsion only by itself. Is this how Newton proved his third law?

Fundamentally: The prime motivating root cause of a mass motion action is the work performed on the mass, which causes the subordinate intermediate action of impulse which obtains the end result, which is the kinetic energy of the mass. Without work performed there can be no impulse and no end result of kinetic energy. From the presented facts we can postulate the assumption of Newtonian Physics: The Newtonian relationship of uniform gain in mass acceleration in respect to an uniform force applied assumes that the energy source itself causing the mass acceleration is not being depleted or its source energy flow diminished by the energy flow demand
of the mass acceleration. Furthermore, that the energy flow is not causing a negative feedback loop and therefore not causing motions in the complex matrix plane. Does Newtonian Physics violate the conservation of kinetic energy principle or the cause and effect principle, the negative feedback principle or the complex plane principle? It apparently ignores all of the four. The Engineer has to sort out how a system transfers energy when mass motion acceleration takes place and whether or not it generates self-contained motivating impulses. Newton’s equal reaction to an action does not consider kinetic energy transfer/depletion/flow, cause and effect, mutual separating and combining of masses, negative feedback and complex plane implications, subsequently ought not EVER be cited as contrary to inertial propulsion. Newton himself stood clear of extending his third law to rotational projected onto straight line motions. Physics is after all, foremost, the study of energy and matter.

A voice of reservation to Newton’s time based Impulse/momentum physics came from the inventor of the pendulum clock, Christiaan Huygens. Huygens already suggested in 1668 AD, 19 years prior to the publication of Newton’s laws, the importance of the product of force applied over a distance in respect to inertial mass motions. Christiaan Huygens’ presentation was made during a Royal Physics Society meeting clarifying the principles of inertial mass motions?????. A further strong voice from the force and displacement camp was Robert Hooke who postulated Hooke’s elasticity law k=force/distance. Hooke’s law is indispensable when analyzing systems having cyclic oscillations. Is it possible to engineer Christiaan Hyugen’s pendulum clock with impulse / momentum alone disregarding the periodic potential energy of the pendulum weight * height? No, height is included in form of the pendulum length. Because, the clock engineering needs the potential energy of the pendulum weight height as the root cause of the mass motion, as we have demonstrated in all previous examples. Still today, Physics textbooks separate the time domain analysis of impulse/momentum and the displacement domain analysis of work/energy like fire and water, while both, time and displacement domain analysis have an isomorphic symmetry. This means, we apparently do not have the best workable tools available for Physics of mass motion, if we cannot directly and easily correlate the two analysis systems with formula #7. The analysis of dynamic mass motion using the work-kinetic energy principle has a long history. Galileo demonstrated the principle of the steady gravitational force mass motion by rolling steel balls down a notched board which illustrates the relationship of a progressive decreasing time duration for each repeating motion length and height traversed. In concert, Gottfried Leibniz postulated that the living force of a mass in motion having
a proportional relationship of the mass reluctance multiplied by the squared mass velocity relative to the motivating force multiplied by the motion length traversed. Further congruence was provided by Heinrich Hertz through his publication “The principle of mechanics presented in a new form”. Wherein the mass motion motivating force passing a distance is presented as proportional to the applied energy. Impulse is accordingly an intermediate parameter derived from the root cause of the motion, which is energy. Albert Einstein attributed some of his thought processes partially on Heinrich Hertz’s publication, thereby leading to the invention of relativity having its logical origin in the kinetic energy flow of the pendulum and the energy flow of the rotational to straight line coupled motion.

The crossbow, a weapon still in use by game hunters in 1668, develops the velocity of the arrow according to Sir Newton’s impulse. However, how could Sir Newton calculate the velocity of the arrow using impulse or acceleration, the product of average force multiplied by the time of applying the force to the mass of the arrow? Time and velocity are TWO unknown parameters? The velocity is what we are seeking, the time factor is the difficult part to answer, as Galileo showed with his astounding experiment of notches in the declined track of a rolling ball having exponentially decreasing beat frequency.

The force and displacement of the crossbow string are both known quantities and both force and displacement are vector quantities because displacement has also a three dimensional direction!? The three dimensional direction of the crossbow string displacement launches the arrow with one single vector dimension of impulse!!!. A vector multiplied by a vector ought to be a vector quantity but why is work done on the arrow NOT considered a vector quantity?? The process of aiming the crossbow are steps done aligning the force and displacement of the crossbow string in a three dimensional direction with the target! Denying therefore the work done by the crossbow string the status of vector seems strange indeed and represents one of the barriers to the complete understanding of inertial mass motion applying to vehicular motion. The author was unable to obtain a better explanation for the necessity for separating impulse from work done, and the need for separating the relationship of the impulse vector from the work done (possible vector) that is: Force * displacement distance is an area-geometric figure of two scalar vector quantities. This publication therefore cautiously postulates that perhaps Quantum-Physics might explain this discrepancy between vector and scalar value better as we have seen in the Gyrobus transmission example.

The suggestion by Christiaan Huygens to use work/energy, the product of force times displacement, would have required an additional step of physics thinking (or
is it assumption?) to solve all the previously presented problems, namely that: The application of a steady uniform force generates a steady uniform gain in inertial mass motion velocity, which is Newton’s acceleration, because then, the displacement is ½ of the square of the velocity divided by the acceleration, which is more a geometric rising slope triangle area problem than mass motion physics problem. Therefore, we can extrapolate that Force * distance = 1/2 * mass * Velocity², gain, which solves the velocity parameter and sidesteps the time and the acceleration parameter ingenuously, the 100 year later discovery by Cariolis. However, the application of uniform gain in inertial mass motion velocity in respect to time domain raises the second important logical barrier to inertial propulsion, the work / energy of non uniform acceleration versus uniform acceleration presented in formula #4, dealt with again later in this publication.

However, Newton publicly resented the privileges of inventors riding on the coattails of his important scientific discovery of the centripetal acceleration. But then again, why blame Newton for the skill and foresight to avoid controversy and keep his laws simply in the time domain analysis and not to include work/energy nor rotational pendulum motion combined with straight line reflections in his Principia? When analyzing motions involving only friction and potential energy without an inertial mass we find a further consequence of the impulse to kinetic energy relationship, the average force versus kinetic energy flow relationship, where kinetic energy flow is horse power or kilo-watt, which is an uniform relationship in respect to the time interval, double the time interval per kinetic energy flow (Hp) will double the force available to push the car. Yes, therefore, heavy loaded trucks go slow up the hill.

**FORCE, average, Kgf = HORSE, power * time / distance**

Therefore: by multiplying both sides of the formula with time we get:

**Impulse, Kgfs = Energy, gain / Velocity, average**

If the velocity gain of a repetitive non inertial motion is constant then the magnitude of the impulses are in uniform step with the energy quantity applied. More energetic energy pulses result in larger impulses, which is good news for inertial propulsion design.

The earliest example of using the combined vector sum effort of straight line displacement and rotational kinetic energy to produce a large straight line displacement force impulse is the carriage mounted medieval catapult called "Trebuchet". The carriage of the Trebuchet is not only used for positioning but it’s main function is to improve the projectile range. The improvement in range of this catapult was apparently due to the simultaneous combined effort of straight line and rotational kinetic energy and the time spaced delayed lever action of the whip.
attached to the throw arm. This delayed action is profoundly different than the instantaneous action of impulse and velocity gain in a straight line inertial mass motion. Since Newton pronounced to keep rotational motion projected onto straight line displacement reflections out of his Principia, the trebuchet principle can not be found with in it. However, the centripetal acceleration which gave us the understanding of planetary arc motions, can be found in the Principia. Newton regarded the centripetal acceleration as a separate invention from the straight line displacement mass motions. The centripetal / centrifugal acceleration is also the underlying principle and the root cause of the trebuchet operation.

The straight line displacement motion component contained within the total trebuchet motion, which is operating in the direction of the throw of the projectile, is caused by the large inertial reluctance of the counter weight reciprocally inducing a straight line displacement motion into the carriage and also into the throw-arm from the rotational potential energy of the counter weight. Any carriage friction to the ground will diminish the total angular acceleration of the throw arm, therefore friction is diminishing the range performance of the wheeled trebuchet. Accordingly, friction is not the root cause of the trebuchet operation, as claimed by the stiction / friction arguments contrary to inertial propulsion and must be expelled / denied from the root cause analysis procedures. The “Trebuchet” was also the first device to generate such a large straight line displacement force by angular acceleration of a rotational rotor mass within less than one half revolution of the rotational motion employing the proportional relationship of the centripetal force over a rotational distance to the kinetic energy of a rotating mass. The angular acceleration of the trebuchet throw arm structure does not induce a net straight line motion of the center of mass CM of the aggregate trebuchet system, the CM stays stationary during the acceleration. This means: The trebuchet mechanical oscillator receives it’s frequency modulation independent of an external reference point, independent of a backrest or steady-rest. With fine tuning of the Trebuchet lever actions, it is possible to convert up to 65% of the potential energy of the counter weight into motion energy of the projectile depending on the transmission ratio of the whip length to the throw arm length. Wherein only 35% of the potential energy is lost into the recoil actions. This fine tuning application demonstrates that the Trebuchet recoil action is a variable parameter unlike Newton’s third law invariable instantaneous equal re-action to an action and it demonstrates that the centripetal acceleration has different capabilities then the purely singular straight line displacement motion acceleration. The original carriage mounted Trebuchet, however, has only one charge of potential energy per operational cycle while the present described Inertial propulsion System has two
alternating energy charges per operating cycle. To be fully congruent with the operation of the presented Inertial Propulsion Device an additional mechanical pull mechanism, having an opposing potential energy charge, must be present on the throw arm to motivate an additional flywheel. The additional flywheel is independently rotatably mounted onto the exact final center point of gyration of the throw arm. The additional pull mechanism is motivating the flywheel up to the exact rotational momentum magnitude and opposing rotational direction as is remaining in the counter-weight/throw-arm after the throw. The additional flywheel momentum must engage with the flywheel in a timed rotational reciprocal energy absorbing collision to oppose the counter weight/arm remaining momentum, present after the projectile throw. The additional flywheel momentum is negating the recoil of the throw arm to an exact zero momentum and accordingly zero trebuchet-system recoil because of the collapse of kinetic energy being the root cause of the action then causing the reactive momentum in the counterweight to collapse as well. This root cause and effect sequence is the same as in the Gyrobus where the rotating vector momentum quantity is absorbed into kinetic energy. Such an improved Trebuchet exerts a large self-contained real effective impulse component against the projectile avoiding Newton’s third law dynamically by dual time spaced reciprocal distribution of energies inverse proportional to the ratio of the component masses. The physics principle of the improved Trebuchet can be further placed in congruence with the non-harmonic oscillation of an oscillator pumped by alternating energy pulses having a non-resonant frequency to such an extend arresting the oscillations, thereby having the largest possible gradient complex plane projection. The simultaneous combined straight line and rotational motion of the improved Trebuchet has non-harmonic motion similarities to the presented Inertial Propulsion wherein the projectile exerts an impulse against the aggregate mass of the vehicle, while the carriage is displacing straight line within the vehicle. Furthermore, within the present Inertial Propulsion Device the alternating energy pulses and the mechanical leverages are fine tuned to accomplish a continuing rotor rotation having motions with the largest possible gradient complex plane projections, the largest possible average angular speeds with identical straight line carriage speed amplitudes, consequently having a high relative real effective thrust yield. However, it is important to note: All these relationships are rotating vector quantities from the complex rotation of the fulcrum arm structure having a direct proportional relationship with the centripetal forces over the rotational displacement. At the same time, the counterweight is having a straight line displacement motion vector opposed to the direction of the throw motion of the projectile and the carriage, this must be viewed as a potential equal straight line
displacement reaction to the projectile throw action matured at the end of the trebuchet cycle.

Here is where we arrive at the point where we reduce the equal reaction forces to zero without negative consequences: Because of the dual existence of the straight line displacement momentum vectors also existing as rotating kinetic energy magnitudes at the exact time the projectile separates from the throw arm. If we diminish the rotating vector energy quantity with a RECIPROCAL energy absorbing collision we will thereby also diminish the unwanted counter weight straight line displacement momentum vectors to zero and arrive at a reaction less projectile throw. Accordingly, effectively locking the projectile momentum into the system if the modified trebuchet were an isolated system. So here we have IT, that’s how its done. Important again, is that it must be a rotational reciprocal energy absorbing collision type where the center point of rotation must be exactly AT the final center of mass of the final rotating mass configuration excluding the projectile. Any offset to the final CM will diminish the null action-result of this collision leaving a unwanted rest reaction because of the exponential factor of the Huygens-Steiner theorem. This principle should come at no surprise, as it is consistent with the Gyrobus example. It is also consistent with the reversibility of physics functions, where the rotational acceleration has the same principle as the rotational de-acceleration, only having different directions. Additionally, the reciprocal nature of the collision satisfies the conservation of rotating momentums wherein the sum of all momentums, when including the isolated systems’ straight line momentum, the sum of the induced momentum minus the removed momentum, is constant. Accordingly, there is again, no issue of violation of conservation principles. The rotational centripetal forces are created from a force couple on the balance beam lever connecting the counter weight and the throw-arm from a store of potential energy. The force couple are two equal forces pointing in the same direction, thereby squeezing against each other. The forces of the trebuchet force couple however are separated by the distance between the mass-center of the counterweight to the pivot of the throw-arm creating a rotational moment. The force couple of the trebuchet creates an additional mass motion kinetic energy exchange, which is different, then Newton’s instant force couple of the third law. Thereby, the working principle of the carriage mounted trebuchet and for rotational to straight line displacement coupled motion in general the Huygens-Steiner Theorem applies. The Huygens-Steiner Theorem is also called The Parallel Axis Theorem. The parallel axis theorem tells us that a forced point of rotation having a distance to the natural center point of gyration at the center of mass makes a rotating mass structure having a larger reluctance to rotation. Therefore, the
structure is having a larger ability to store kinetic energy by the square in the offset distance. This principle has its root cause in Huygens centrifugal acceleration / Newton’s centripetal acceleration of rotating masses, an exponential function both are congruent to the vis viva:

\[ \text{#9) acceleration, centripetal} = \frac{V^2}{\text{radius, gyration}}. \]

In case of the carriage mounted trebuchet the offset distance is large, because the natural center point of rotation is very close to the center of mass of the large counter weight. In contrast, at the start of the throw arm rotational motion it is forced to start to rotate at the fulcrum pivot. When the throw arm rotation gains speed, the center point of rotation shifts to the natural center point of rotation which is at the CM of mass of the whole rotating structure. This is increasing the rotational speed a great amount because the total system energy is conserved and remains constant. However the ability to store energy decreases with the rotational speed. This shifting from the forced center point of rotation at the fulcrum pivot to the natural center point of mass being the preferred center point of rotation is caused by the exponential nature of Newton’s centripetal acceleration applying to the component masses causing large forces within the throw arm structure having the force root origins at the center of mass of the rotating structure. This principle delivers an avalanche of kinetic energy into the trebuchet throw arm tip containing the projectile. This is a similar action as seen in electro dynamic coils generating large energy sparks, as predicted by Heinrich Hertz in his before mentioned book.

Is it possible to use the carriage mounted trebuchet principle to power one single cycle of inertial propulsion? Yes, it is, the author Gottfried Gutsche has patented an Education Device for demonstrating the generation of 1 Newton second magnitude of self contained impulse. The progression of the operational cycle of the Education Device is shown on the “Mindbites.com” web site: www.mindbites.com/series/1278 lesson 7

Then we must ask: Where is Archimedes fixed point, the backrest, the steady-rest, in this dynamic process? to throw the projectile without any recoil. The answer is contained in all the previous examples: The trebuchet throw arm with the counterweight and the projectile still present performs a rotation around the natural center point of rotation, just as the flywheel in the Gyrobus has a natural center point of rotation. If the kinetic energy of the trebuchet throw arm structure is removed in the same logical way as seen in the Gyrobus technology and this energy removal is the root cause of a rotational energy collapse and the rotational energy removal is at the new preferred center point of rotation excluding the projectile mass, then, the rotational vector momentums contained in the throw arm mass and counter weight
mass components are removed. EXCEPT, the kinetic energy of the projectile, which is free to fly on as a vector quantity onto the boundary of the system and will continue onto the boundary of the system because of the conservation of straight line and rotational kinetic energy and conservation of straight line and rotational momentum principles. With the Gyrobus and the Inertial Propulsion Education Device as physical proof we can postulate with certainty:

A mechanism is capable of inducing a straight line directional internal (vector) impulse into a self contained quantity of mass from a quantity of potential energy independently of any recoil action ONLY IF the root cause of the internal mass motion action is a reciprocal rotational kinetic energy flow exchange causing a rotational kinetic energy collapse. In view of the presented principles it is incongruent to elevate impulse and momentum as the superior elements of mass motion, instead the root cause of potential energy and the resultant effect progression sequence is the underlying principle. Formula#6 is modified for converting rotational kinetic energy into impulse: Impulse, self-contained, \( N_s = \frac{1}{2} \times \text{mass, projectile} \times r^2 \times \omega^2 \), speed, max, Then

\[
p, N_s = \text{mass, projectile} \times r \times \omega, \text{speed, max}
\]

The primary working process of the presented continuous cycling Inertial Propulsion Device is the straight line to rotational coupled mass motion. When implemented in its simplest form, a rotor-crank coupled to a straight line sinusoidal reciprocating mass motion by means of a straight line to rotational coupled Transmission Mechanism. Wherein every \( \frac{1}{4} \) rotor turn is corresponding to one reciprocal motion direction having a different average angular speed magnitude. The rotational to straight line coupled transmission is a mechanism converting rotation into straight line displacement motion following a cyclic fixed progression of transmission ratios. Newton called this rotation to straight line displacement coupled motion very descriptively “straight line reflections of rotating motions”. For our example, we use the Scotch Yoke which follows a true sinusoidal transmission ratio. The straight line to rotational coupled mass motion is of premier importance because the prime originating source of the straight line shot put motivating force is Newton’s steady continuing centripetal rotational force vector generated from the rotational arc motion of the rotor-crank-pin applying formula #9):

\[
Z = \text{Force, instantaneous, centripetal} = \text{mass} \times \text{Velocity}^2, \text{tangential / Radius, gyration:}
\]

Ref. www.wikipedia.org/wiki/Centripetal_force

The most important aspect of the centripetal force is that the energy stored in this rotational system is the centripetal force times the rotational displacement
distance, it makes the rotational system an energy storage and energy supply device. Important is that the rotational displaced distance traversed has a time duration proportional to the average angular speed, we have a force and time derived from speed, when both are multiplied we have impulse. Accordingly, it is proven fundamental Physics to designate the rotational to straight line displacement transmission an energy to momentum converter applying to formula #6. This conversion process has already been thoroughly proven with the Conveyor, Skaters, Gyrobus and the Trebuchet experiments. Furthermore, within the centripetal force there is no mass motion speed gain (speed amplitude) to average speed relationship, as we have seen in the straight line displacement mass motion of the race horse in formula #4, only the magnitude of the tangential velocity vector magnitude in relation to a constant radius is causing the centripetal acceleration. Accordingly we can say: The average speed, within an arc motion, is the vector velocity divided by the radius. The radius parameter is in-extricable, in-disentangle-able from such a rotational motion system by any analysis views or any formula manipulation, no matter whether we are looking for impulses or for energy storage applications. The centripetal Force is in good Physics books denoted with Z because it is a complex function. The underlying root cause are the ratios of dimensions within the triangles applying to a tangential segment of a circle wherein the segment squared length (the length of the cut through the circle rim) has an uniform relation to the product of segment height (the segment distance to the circle rim) times the invariable radius, $s^2 = h \cdot r$. Wherein $s =$ tangential velocity and $h =$ acceleration. Accordingly, the centripetal force is a displacement analysis related to formula #1 wherein the new angular velocity is the same as the previous angular velocity if the angular velocity is constant and where the difference of new and previous angular velocity applies to the frequency modulated angular velocity used within the Inertial Propulsion Drive. We can credit Newton for a fine human intelligence performance to first recognize this very important relationship of circular motion and to recognize that it was a different concept then his straight line displacement force in the time domain. However, it was Huygens who promoted the importance of the displacement domain analysis and the Huygens Steiner theorem applying to the centripetal force. This principle is causing the rotating velocity vector magnitude to act both as velocity gain and also as velocity average, as seen in formula #4 and #7. Accordingly, we must use the vector Velocity\(^2\), this is describing an exponential system where energy and force are able to perform avalanche exchanges as we also experience in electrodynamics of collapsing coil magnetic fields and optic-dynamics of lasers. From the steady continuing centripetal rotational force vector we extrapolate the straight line motion shot put force using a
trigonometric vector projection (reflection) for the sinusoidal motion. Because the physics of the rotational to straight line displacement coupled motion has it’s fundamental principle in Huygens’ centrifugal acceleration and Newton’ centripetal acceleration, it also applies again, at the same time, to the Huygens-Steiner Theorem. This is caused by the variations of the Center of Mass within the total aggregate system and the in-variable center of rotation of the rotor, as we have seen in the trebuchet example an exponential relationship.

The centrifugal / centripetal force, a rotating vector force couple, has therefore a steady continuing scalar presents from a steady presence of angular velocity and is an exponential magnitude of each angular velocity magnitude at each and every angular position incident of the rotational motion, this magnitude of acceleration per angular position (the angular value) theorem has been proven to be independent of the any speed variations of the rotational motion over the motion distance. Ref.:www.farside.ph.utexas/teaching/301/lectures/node89.html

Consequently, the centripetal force is directly proportional to the momentary kinetic energy content of the rotating rotor mass rotational displacement and energy is accordingly the root cause of the centrifugal- centripetal force couple. Importantly to note again is that the centripetal force is a force present for every position of a rotating structure congruent with formula#1. In contrast: Newton’s force caused by straight line displacement acceleration is a mean value force over the time duration. However, because the periodic cyclic motion of a reciprocating mass has both a time duration and a centrifugal force magnitude for every position, then periodic straight line displacement motion accordingly is also caused by an impulse. The impulse is the isomorphic symmetry of kinetic energy/work to impulse and also the force multiplied by the time duration. Here again most importantly, as we found with the Gyrobus, the mathematical representation of the rotational to straight line coupled motion can not be described with impulse causing momentum but with energy causing impulse considerations because of the inherent transmission and flow of stored kinetic energy. Then, the rotational to straight line coupled motion is related to the forces of the Hammer Throw Sport involving tethered mass motions and is NOT related to the shot put sport. Which of these two sports gives the greater throw distance with the same body energy? The centripetal force is presented in text books having, for each and every individual straight line displacement position of the rotational coupled straight line motion, a force magnitude of:

**Force, instantaneous, N=mass, \(4\pi^2\) displacement, straight line/ time², cycle**

converting the displacement to angular position \(\pi\) we get:

**Force, instantaneous at position, N=mass*\(\pi\)*\(\omega^2\)*\(\cos\pi\)**
Ref: Geeck formulas L10 Scotch Yoke
www.farside.ph.utexas/teaching/301/lectures/node89.html

The maximum centripetal force is exerted when the straight line motion displacement position is equal the rotor crank radius. This means, the instantaneous force is growing exponentially with the prevailing base cyclic frequency \(1/time^2,\text{cycle}\). The average force for each 1/4 cycle rotation of the crank is for uniform rotation the maximum centripetal force multiplied by \(2/\pi=0.637\) which is called the mean value theorem averaging. If we want to use the “Root Mean Square (RMS)” averaging” we use \(\sqrt{2}=0.707\) modifier. Which averaging is more accurate? Computer integral calculation indicates that for non-uniform angular velocities the actual real average is the average of the average of mean value averaging and the root mean square average.

Important is to remember that the calculation of the average force is the force delivered by each 1/4 turn of the rotor which is DIFFERENT for EVERY 1/4 turn IF the average rotor angular velocity is different for the 1/4 turn. This principle is telling us that it is possible a gradient self contained mutual reciprocal energy distribution is present for every 1/4 turn of the rotor.

The rotational to straight line coupled motion follows a harmonious motion if the straight line motion velocity gain, which is \(V, \text{gain} = 2*\pi*\text{radius}/(\text{time, duration per 1/4 cycle})\), is arriving exactly at 1/4 turn of the rotor. The force averaging for non-uniform frequency modulated combined straight line displacement to rotational mass motion will be logical exhaustively proven using the average of the mean value theorem in the main body of the publication. Accordingly, we use the average angular velocity occurring at 1/8th of the 1/4 rotation and then apply the rise over run to this average angular velocity. Is there an assumption in this method diminishing its general applicable validity? The only assumption is that the frequency modulation is a steady uniform changing modulation for every increment of angular displacement. When we recheck the validity of the average of the mean value with formula #7 which we promoted to have the highest validity, we find that the force average and impulse returned is only slightly less using formula #7 but with absolute certainty is returning a self contained impulse quantity within a frequency modulated inertial propulsion cycle. Accordingly, the average of the mean value has a very high validity status and ought to be generally accepted in school physics books but can only be found in bits and pieces therein.

The flow of kinetic energy for these 1/4 rotation examples is between the rotor-crank/cam and the straight line reciprocating mass, alternating reciprocally between the rotor-crank and the straight line displacing mass while the systems’ total
kinetic energy magnitude is conserved. Thereby, straight line displacement kinetic energy is flowing into rotational kinetic energy and vice versa, employing the two vector dimensions of mass motion. The energy flow for harmonious cyclic motion is basically identical to the straight line conveyor example, by using the mean value theorem, we multiply the maximum force by the averaging factor $2/\pi$ thereby obtain the mean value of force, force multiplied by velocity is then power flow:

$$\text{Power, average, Kwatt} = \text{mass} \times 8 \times \pi \times \text{Radius}^2, \frac{\text{crank}}{\text{time}^3}$$

The mechanical power-flow magnitude is a measurement of the required stencil strength of the mechanical components and motor size requirement. Furthermore, because the mass and the radius is invariable, the formula therefore means: Even a very instantaneous small localized variation of the cycle time duration will overwhelmingly, in a cubed progression, affect the internal power flow, but it will affect the mass motion straight line displacement impulse in a proportional relation in respect to the momentary angular speed per angular position. Accordingly, the impulse to power flow is a diminishing returns function in respect to the impulse applying to formula #6. Within discussions of IP principles, it can be found that this relationship is again and again misconstrue by an ingrained incorrect strange believe of proportional relationship of IP thrust to internal power-flow. Here we can present again: Power flow, in any system having a delay reluctance is a function of the cycle frequency, which is a fundamental principle in Physics. Of course, this power to cycle frequency relationship is reversible. The systems cyclic frequency depends on the systems ability to deliver additional energy into the system, the energy demands is then limiting factor of the IP thrust. The most important aspect of the mechanical coupling of rotation to straight line mass motion is the inherent temporary kinetic energy storage and kinetic energy distribution cycle. The rotational kinetic energy of the crank rotor is distributed into the straight line reciprocating mass motion and the process reverses where the kinetic energy of the straight line reciprocating mass is accumulated into the crank rotor. This statement, however, assumes that the rotor is stationary. When the rotor is having a straight line displacement and the rotor axis bears both the straight line displacement mass reluctance and the rotational mass reluctance, then the kinetic energy flow is distributed and re-combined between the rotational and the total straight line vector dimension of mass motion. The distribution ratio is then the reverse ratio of masses as previously presented in the separation of two unequal masses by the stored energy of a spring, a feedback principle. Because of this feedback principle, the impulse for every 1/4 turn is different if the initial potential energy condition of the angular speed is different at the start of the straight line displacement. Accordingly, we are at liberty to use
formula \#6 to convert the potential energy / work performed into an impulse magnitude because this formula always returns the real usable portion of impulse. Did Newton know this principle already and was this the reason he stood clear within his principia of the rotational to straight line coupled motion? Most likely, because all we have to do is couple a straight line guided inertial mass onto a pendulum through a connecting rood and there we can observe this rotation to straight line coupled motion flow principle in the time domain as well in the displacement domain. Proving again the flow principle of impulse / momentum by Hermann and Schmid. Then we can postulate with certainty: Within the rotational to straight line coupled motion of the inertial propulsion device the performed

**Impulse is an isomorphic function of potential energy, the Impulse is a proportional function of angular velocity.**

When we look at the similarity of the rotational to straight line displacement coupled motion to the mutual reciprocal separation of unequal masses we must point at the difference between the separation by the mechanical power of a spring and the separation by the power of a rotational inertial mass motion.

**The Proof**

To present and proof the mutual separation of unequal masses by rotation of an inertial mass moment we must present the modified scotch yoke mechanism in the next Fig.1 to formulate a mechanical mechanism capable of continues self-contained impulses. In Fig.1, the combined mass of flywheel 1, flywheel 2 and the motor generator is being accelerated in a straight line starting motion by the rotational motion of flywheel 1. Subsequently, is de-accelerated by a straight line stopping motion conserving the longitudinal kinetic energy back into flywheel 1, a self contained dynamic braking system wherein the accumulator (battery) is the flywheel 1). The inertial mass moment of the flywheel mass is variable in congruence with the trebuchet example. The inertial mass moment is depending not only on the radius and the mass but also on the orientation of the crank. When the crank-tether is in the horizontal position the mass moment is purely a flywheel 1 moment, when the crank is in the vertical position the moment of inertia is a tethered (pendulum) inertial mass moment following the Huygens-Steiner theorem:

\[
I_{\text{total}} = I_{\text{flywheel,1}} + r^2(Flywheel,2,\text{mass} + Motor,Generator,\text{mass})
\]

 Accordingly, the angular speed is variable, varying up and down to accommodate the stored kinetic energy in a varying magnitude of the inertial mass moment. A further increase of non-uniform angular speeds is accomplished with the pulsed torque exertions by the motor-generator exerting between the flywheel 1 and 2. A pulsed torque during the stopping motion is increasing the angular speed but no
net exertions against the isolated system occurs because of the conservation of energy in congruence with the trebuchet (the mutual reciprocal dynamic braking). This is shown with the cyan color force couple. Further analysis of this principle is in Fig.1b. At the end of the document.

During the subsequent starting motion a negative torque reduces the angular speed by the mutual torque exertion between flywheel 1 and 2 causing large non-uniform angular speed independent of any net exertions against the scotch yoke device frame. This is shown with the red force couple against the device frame and the straight line motion of the flywheel - motor-generator mass applying the formula #8. This red force couple is a force couple for every position of the tether, every change in position has a time duration and therefore a impulse magnitude. The average force, time duration and impulse is at 45° indicated with a vertical time vector length at evry position. If the scotch Yoke is held stationary, the rotational kinetic energy accumulated in flywheel 1, during the stopping motion, is returned to the power supply. If the whole aggregate inertial mass of the scotch yoke frame moves-accelerates then the difference between the positive torque and the negative torque is motivating the device, because the difference in torque is causing a difference in directional impulse magnitude.

Referencing Fig.2, Fig.2b, the straight line motion instant force (Fig.2, the 4 **** color lines) causing the starting motions are plotted for 4 different angular speeds in \( \omega = 10 \) 1/s increments are (the 4 solid ____ color lines) causing to the starting motions in Fig.1. The 1/4 time durations are the vertical -..-..-.. lines. Fig.2b is the straight line motion velocity plot which is out of phase by 90° from the real force plot having a real tangential line and a phase shift tangent line. Then it is proven that the mean value of real force is always at the physical position of 45°, at this point having a force RMS averaging factor of \( \frac{1}{2} / 2 \) and force mean value factor of \( 2/\pi \), this is indicated with the horizontal -.-.-.-. color lines. The RMS factor returns a 0.05 larger impulse value than the mean value, the mean value is the minimum expected impulse value. This inter correlation has been already proven to be independent of the angular speed non-uniformity progressions, wether \( \omega, a=\omega, b \) or \( \omega, a>\omega, b \) makes no difference, the final formula remains the same. Then, the area of the impulse is circumscribed by points ABE>ACD and is also ABE=1.2ACD. This incontestible proofs that the Impulse is equal to:

\[
p = mr\left(\frac{1}{2}(\omega, a+\omega, b)\right)
\]

for every 1/4 turn. Impulse is accordingly proportional to the average angular speed.

Furthermore, it also incontestible proves that the impulse is proportional to the average angular speed for ever 1/4 turn of a spin if the spin is non-uniform (is
variable). This appears as a fundamental concept in nature congruent with photo-voltaic dynamics, Thermo dynamics and electro dynamics.

Fig.1

\[ a = \omega^2 s \]

\[ s = r \cos \varphi; \text{ mean value } a \text{ is } \varphi = 45^\circ \]

Flywheel 1 is mounted onto the motor generator shaft.
The Tether (crank) is mounted onto Flywheel 1.
The Motor-Generator housing is firmly embedded into Flywheel 2.
The solid Tether (crank) is shown at a starting motion.
The dashed-cyan Tether (crank) is shown at a stopping motion.

Two alternating FM modulating PWM pulses are applied to the motor Generator during the consecutive stopping and starting motions.

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The mechanisms described by this publication are protected by patent applications:
Fig. 2

1/4 turn impulse plot

- $r = 0.01 \text{m}$
- mass = 1 kg
- $a = r \omega^2 \cos \varphi$

1/4 cycle time = $\pi / (\omega_a + \omega_b)$

- instant-Force at angular position
- mean value Force
- 1/4 cycle time duration
- $\omega = 1/2(\omega_a + \omega_b)$

- ABE > ACD
- ABE ≈ 1.20 ACD

Total cycle times

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The above Fig.3 graph illustrates the exponential character of straight line displacement forces at play, operating the combined effort inertia drive. The forces
are calculated for a total straight line flywheel assembly stroke of 20 mm and therefore a radius distance of 10 mm for each acceleration and de-acceleration. The straight line forces have exponential character, which limits the possible maximum obtainable propulsion forces due to the limitation of the stencil strength of the construction material. The impulse is force multiplied by the time duration for every displacement section. The impulse is rising proportional with the magnitude of the angular rotor velocity. This graph illustrates the very important fact that the performance of the combined effort inertial propulsion depends largely on the level magnitude of the angular impact rotor velocity and is **only** limited to the maximum angular rotor velocity possible, which is the stencil strength of the devices’ motion parts. Ref. Kurt Gieck Formulas P.L10; www.epi-eng.com. Then it can be postulated with certainty: **The larger the average angular rotor velocity and the larger rotor angular rotational frequency modulation the larger is the propulsion thrust in a diminishing returns progression.**

To positively illustrate the exceedingly complex IP drive principle of frequency modulated cyclic mass motion having a complex cyclic logic a typical cyclic mass motion contour graph in 1/5 cycle time-rotation increments is presented wherein a 90º rotor rotation is having alternating a 1/5 and 3/10 of the cycle time duration with equal area under the displacement speed curve, plotted in the time domain.(Fig.4):
Blue lines are angular speed, black lines are the reflecting straight line speed, red line are the force and the hatched area is impulse magnitude. The angular velocities \( \omega_a, \omega_b \) and \( \omega_c \) are indicated, but for simplicity reasons a rise of angular
velocity from $\omega_b$ to $\omega_c$ is normally present but not shown and mathematic- and Graphically presented later. In view of the contour Graph it can be postulated with certainty: The final resultant average net inertial propulsion force escalates proportionally with the cyclic input energy gradient, the instant force escalates exponentially cubed with the magnitude of the oscillation frequency gradient and the thrust/impulse escalates proportionally with the angular speed gradient. This is easily observable because the area of average force times the time durations (the hatch areas), which is impulse, is larger in the forward direction then the backward direction. The straight line displacement per 1/4 turn is the area under the velocity curve in respect to time. The geometric dimension of the plot already indicates that the mean value of the reciprocating impulses is the average of the angular speed per each quarter turn, $1/2(\omega_a+\omega_b)$ multiplied by mass and by radius. This postulation will be further proven in the body of the publication by developing the pertinent inertial propulsion formula. For reality-check of the presented impulse relationship view the pendulum test: www.mindbits.com/series/1278 section lesson 8

The Next Fig.1b is a supplement to Fig.1 to identify the nature of the opposing impulses for each straight line starting and stopping motion.
Fig. 1b illustrates the equal action to reaction of modulation forces.

Newton's reaction to an action applies for the FM Modulation. New angular speed is introduced into Flywheel 1 without additional impulse.

\[
\bar{P} > \bar{\bar{P}}
\]

\(\bar{P}\) = the impulses within the opposing starting and stopping motions

\(\bar{P} - \bar{\bar{P}}\) is self-contained
Fig. 2b is supplementing Fig. 2 to proof the effect of velocity phase shift to real force.