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The principle of the optimal motion (full version)

This article is a practical conclusion of the "Hypothesis of the atomic (quantum) motion", registered on the site of intellectual protection: http://www.a-priority.ru/Priority/1estestv/1estestv_catalog.html
registration number: A1B031 (project of the European Academy of Natural Sciences).Hypothesis of the atomic (quantum) motion refers to the section of physics: “Classical mechanics”. This is hypothesis of discreteness of mechanical motion. It represents a new, more profound approach to the second law of Newton.

In brief about the hypothesis: the velocity of a body, moving under the influence of the force, grows not continuously in the time, but discretely (quantums); the cause of inertia of the body is its own gravitational field, because the inertial mass of a body is proportional to the mass gravity. Not yet reacted own gravitational field of a body to the action of the force, velocity of a body will not change; the quant of the motion is the process of reaction of the own gravitational field of a body to the action of the force. This process is periodical and accompanied elementary deformation of a body (reaction gravitational field of a body) and subsequent redeformation of a body in the direction of the travel (after reaction of the field). Thus, the mechanism of body motion under the action of the force is a collection of very small deformations and redeformations of a body. It reminds motion of the caterpillar.

If force, that acts on the body, grows with velocity of reaction of the own gravity field of a body, then the quantum of the motion of this body will be most effective. It is a practical conclusion from the hypothesis, which built on the “Principle of optimal motion”, - the alleged use of the hypothesis: for each mass of the various moving objects (people, vehicles, industrial equipment during switching on, alternating current - as the mass of the electrons, and so on there its optimal (effective) acceleration, that allows to increase efficiency of motion. In this article there experimental verification of the hypothesis.

Millions of the people saw as the apple fall, but Newton asked why.

Baruh Bernard

What may have thought Isaac Newton, or hypothesis of the atomic (quantum) motion.

Recall the famous experiment by Isaac Newton: the scientist sets a dropper on the cart (Fig. 1), the cart moves on the table under the influence of the weight P; with each tenth of a second distance between the droplets increases, the body **m** continually accelerated, i.e. the velocity of the body **m** continuously increases with

time (schedule, Fig. 1), and Newton open his second law: $\boldsymbol{a} = \frac{\boldsymbol{F}}{\boldsymbol{m}}$, where:
$\boldsymbol{a}$— acceleration of the body $\boldsymbol{m}$;
$\boldsymbol{F}$— resultant force;
m – mass of the body.

Let us try to understand this law:

a) body **m** strives to maintain the previous state of motion (the previous velocity), i.e. body **m** is inert;
b) force **F** forces the body **m** to go into a new state of motion (new velocity).

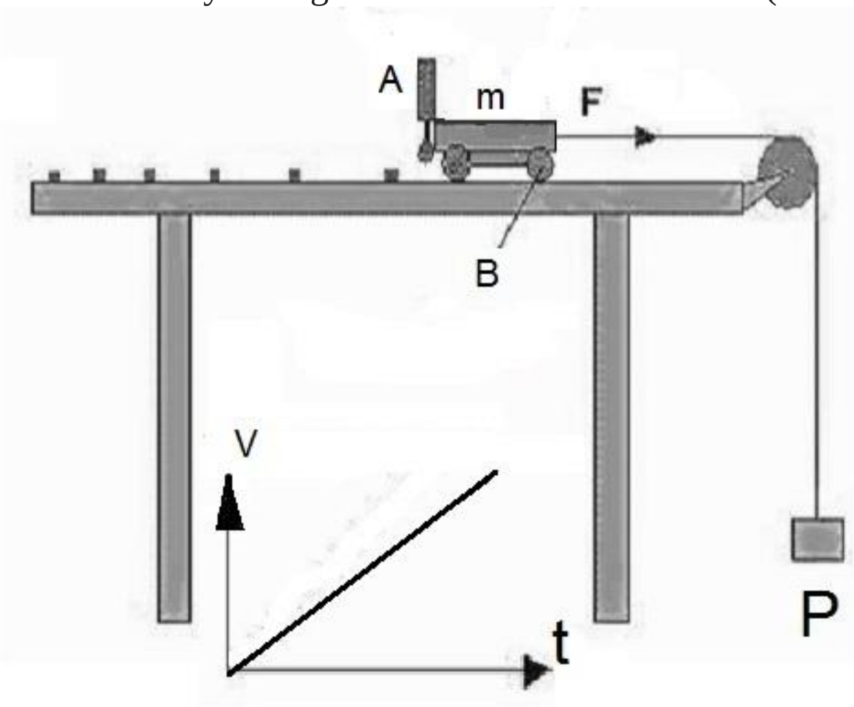

Fig.1. Experiment by Isaac Newton.
A- dropper, B – cart.

Questions arise:

- Is there continuity in time increases the velocity of the body?
- Why does the body can not move immediately to the new motion state (new velocity) – what is the cause of its inertness?
- What is actually mechanism of the movement of the body **m**?

Answers to these questions gives my Hypothesis of the atomic (quantum) motion . So:

Is there continuity in time increases the velocity of the body?

Velocity of the body **m** increases is not continuously, but discrete, quantum (Figure 2-3), by value and direction. Continuous increase of velocity of a body moving under the force would be impossible, because instantaneous transition of the body from the previous motion state in a subsequent, contrary of the inertness of the body itself.

Quant increase of velocity by direction, in this case, is a transition body, moving under the influence of centripetal force, from the previous direction of velocity (vector V1) in a subsequent (vector V2). This is change elementary of direction of the velocity of the body - vector dV, the module is equal to **1/L** (look the Basic condition A of the Hypothesis).

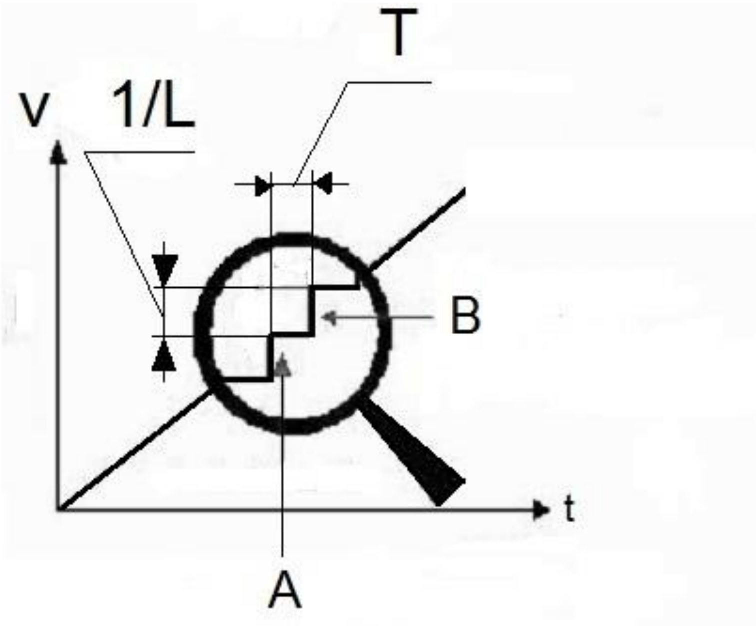

Fig.2.Increases of velocity of the body **m** by value.
A-elastic deformation of the body,
B-elastic redeformation of the body.

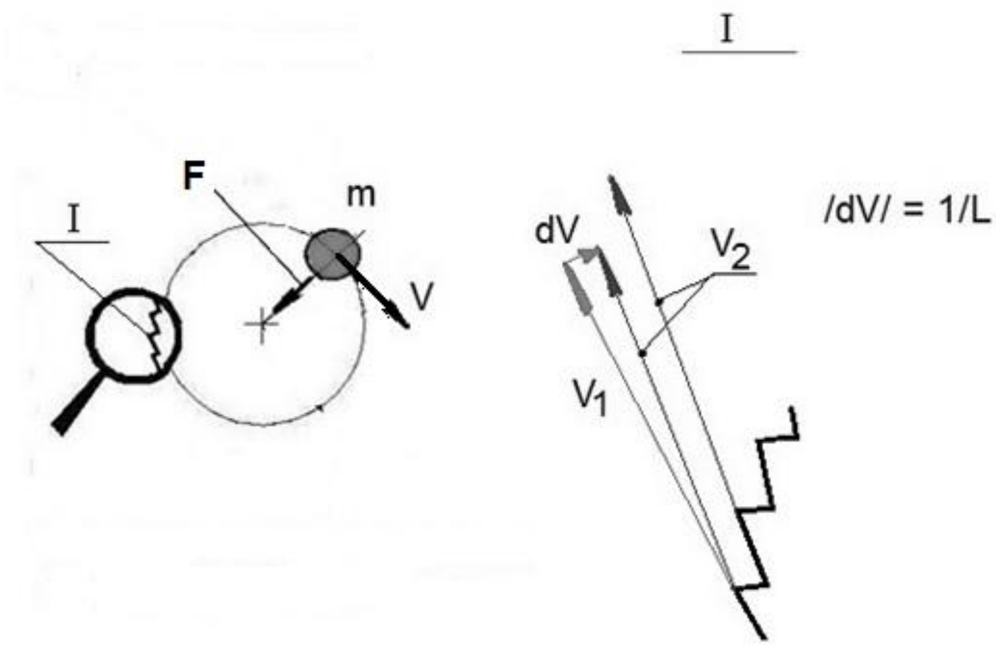

Fig.3.Increases of velocity of the body **m** by direction.

F-centripetal force, V- vector of the linear rotation velocity of the body.

What is the cause of inertness of the body?

The cause of inertness of the body in its own gravity, as the inertial mass of a body is proportional to the mass gravity.[1] This approach to the inertness of a body is inextricably linked with the concept of the atom of the motion.

Atom (quantum) of the motion is the process of reaction of the gravitational field of the body **m** to the action of the forces **F** and the transition the body from the previous state of the motion in the subsequent (the process of change elementary of the velocity of the body, Fig. 2). Each quantum of the motion is characterized by velocity reaction of the inertial mass - **K** kg / s.

It is understood that **K** ≈ **F** or **K = LF**, where:

$\boldsymbol{L} = \frac{\boldsymbol{dK}}{\boldsymbol{dF}}\, s/m$ - change of the velocity reaction of the inertial mass when the force change on the 1 N – value pretends to constant and require experimental determination;

F - the resultant force acting on the body.

Thus, the period **T** of reaction of the inertial mass **m**, or the period of quantum of the motion can be expressed by the formula, which is the basis for our hypotheses:

$$\boldsymbol{T} = \frac{\boldsymbol{m}}{\boldsymbol{K}} = \frac{\boldsymbol{m}}{\boldsymbol{LF}}$$

Formula of the Hypothesis

So, the process of change elementary of the velocity of the body (velocity elementary of the quantum of the motion) takes the form:

$\boldsymbol{aT} = \mathbf{1}/\boldsymbol{L}$,

wthere ***a***-acceleration of the body **m**

Basic condition A of the Hypothesis

In the process of reaction own gravitational field creates a barrier for the movement of the body m, causing it to deform on a very small value **X** (Fig. 4).

After the reaction of its own gravitational field a barrier disappear and force **F** is not active because there is no counteraction of the own gravitational field. But plane by body-creator of the force **F** remain and body **m** redeforms on value **X** to the motion side under the influence of its own elastic forces:

$\boldsymbol{x} = \left(\frac{\mathbf{1}}{\boldsymbol{L}}\right) \times \boldsymbol{T} = \frac{\mathbf{1}}{\boldsymbol{aL^2}}$ - road elementary of the body **m** (Fig.5).

[1]After the publication in 2011 of my hypotheses atomic (quantum) motion, I found information in the Internet about the opening by theoretical physicist Alexander Koreysha made back in 1981. The essence of this discovery, as my hypothesis, is that the body's own gravitational field is the cause of its inertness.

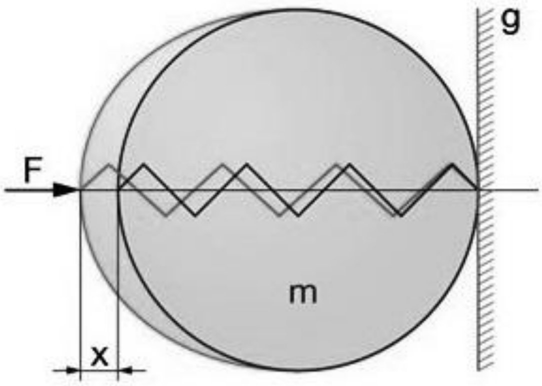

Fig.4. Elastic deformation of the body.
F-the force acting on the body, m-mass of the body,
x-value of the elastic deformation of the body,
g-the own gravitational field of the body.

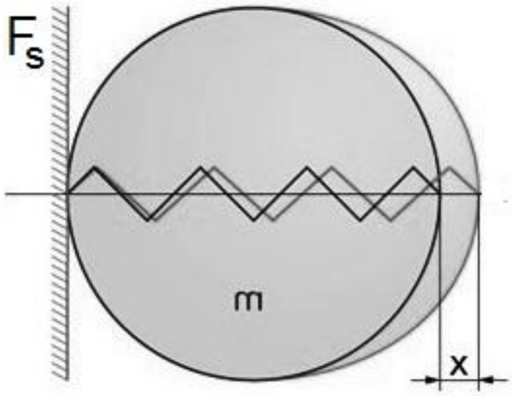

Fig.5. Road elementary of the body.
m-mass of the body,
x-value of the elastic redeformation of the body,
F_s- Plane by body-creator of the force F.

Thus, the quantum of the motion – this is process of reaction of the own gravitational field of the body to the action of the force.

This process is periodical and accompanied by the elementary deformation of the body (the reaction of the gravitational field of the body) and the subsequent redeformation of the body to the motion side (after the reaction of its own gravitational field).

Consequently, force **F** is constantly renewed after the reaction of the body's own gravitational field

Basic condition B of the Hypothesis

What is actually mechanism of the movement of the body m?

Motion of the body **m** under the influence of the force **F** is a collection of deformations and redeformations of the body (the gravitational mechanism of the motion), and like motion of the caterpillar.

Road of the body **m** for run up to speed $\boldsymbol{v = n \times 1/L}$, where $\boldsymbol{n}$- number of quantum of the motion, is equally:

$$\mathbf{0}+\frac{\mathbf{1}}{\boldsymbol{aL^2}}+\frac{\mathbf{2}}{\boldsymbol{aL^2}}+\cdots+\frac{\boldsymbol{n}}{\boldsymbol{aL^2}}=\frac{\mathbf{1}}{\mathbf{2}}\times\left(\mathbf{0}+\frac{\boldsymbol{n}}{\boldsymbol{aL^2}}\right)\times\boldsymbol{n}=\frac{\boldsymbol{n^2}}{\boldsymbol{2aL^2}}=\frac{\boldsymbol{v^2}}{\boldsymbol{2a}}$$

what conform to kinematics of the equally accelerational motion and this is confirmation of the hypothesis.

Try theoretically , or logically determine the value of **L**.

Assume that the force of own gravitation of the body (i.e. the action of the gravitational field of the body by itself) is $\boldsymbol{G\times\frac{m}{X}}$, where:

$\boldsymbol{G = 6,67 \times 10^{-11}}$ $N\times(m/\kappa g)^2$- the gravitational constant,

$\boldsymbol{X = \frac{1}{aL^2}}$— road elementary of the body **m**,

But the force of own gravitation of the body - this is the force of its inertia :

$\boldsymbol{G\times\frac{m}{X} = ma}$, $\boldsymbol{L^2 = \frac{1}{G}}$, where $\boldsymbol{L}$ = **122444** *s/m*.

Of course, this value is based only on the theoretical assumption and in fact may be much greater - so much, so that even the most modern measurement technology does not allow it to determine , and , therefore, to test the hypothesis .

And yet, to determine the actual values of **L** and test the hypothesis is possible practical experiment. On something like may have thought Isaac Newton , but it was impossible to confirm is the quantum motion in his time, having only a ruler, dropper and hourglass. Today for this we have all what you need:

linear scale –a linear scale digital for high accuracy with signal period **4 nm**.For the basis for the such device can be taken linear scale LS-LIP372 German company Heidenhain after several design improvements: the sensor of the linear scale must to move relative to the scale without friction, it is well suited for the purposes of our experiment;

a computer program to count the number of pulses from the generator per one pulse from the linear scale.

During the experiment, the linear scale LS is mounted on a metal plate, which slides on the two metal rollers on an inclined plane. The angle of incline should be minimal to ensure minimal acceleration of the scale. This will get the maximum possible period of quantum of the motion (see Formula of hypothesis), commensurate with the pulse width from the sensor of the linear scale that increase the likelihood of a positive outcome of the experiment.

Sensor of the linear scale mounted on a bracket above the LS at a minimum distance from it.

The contacting surface of the plate and rollers must be high quality to reduce the coefficient of friction.

If the neighboring results of the counting pulses are equal, the movement of the linear scale - discretely (atomically).

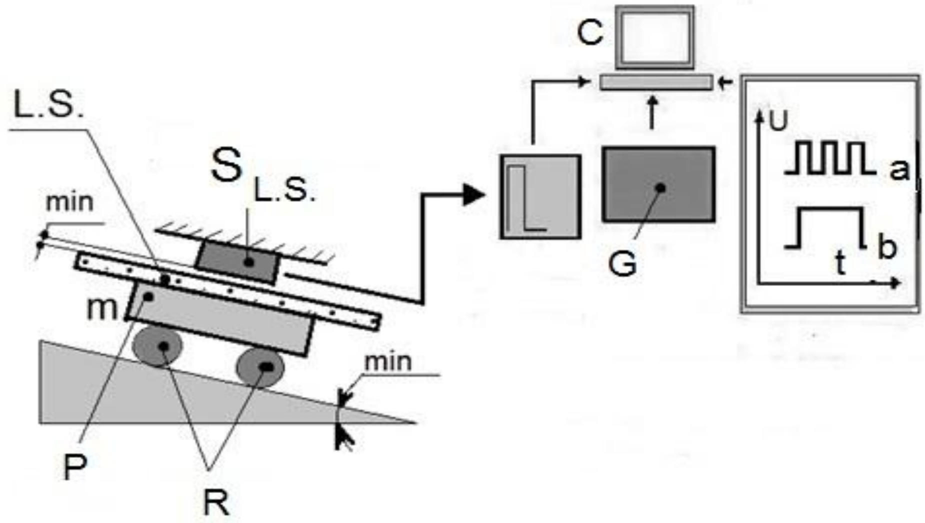

Fig.6. Possible practical experiment to test the hypothesis.
L.S. – digital linear scale, $S_{L.S.}$- sensor of the linear scale,
P – metal plate, R – metal rollers, C – computer,
G – generator, a – pulses from generator,
b – pulses from the sensor of the linear scale,
m – mass of the (P+L.S.).

Pulses from the generator and the sensor of the linear scale go to the computer where the combined in the program for counting.

In spite of the high accuracy of the digital linear scale, its technical possibility may be inadequate and this test do not give the expected results. In this case, for the test and the subsequent application of the Hypotheses of the atomic (quantum) motion can be used practical conclusion from it –

Theory (principle) of the optimal motion and alleged use of hypothesis

What is the use of this hypothesis?
1. Possibly expand the knowledge of the mankind about the nature of the motion.
2. Knowledge about quantum of the motion may make the motion of the people, vehicles, industrial equipment and so on is optimal, i.e. increase the efficiency of engines created by the mankind.

Really, if force, what influence to a body, grow with velocity of reaction of the own gravity field of a body, that quantum of the motion of this body – is most efficacious.

So:force $\boldsymbol{F}$ of engine is a variable in the process of motion (work). If $\frac{\boldsymbol{dF}}{\boldsymbol{dt}}$ - rate of change of engine force, and $\boldsymbol{K} = \frac{\boldsymbol{m}}{\boldsymbol{T}} = \boldsymbol{LF}$ - velocity of reaction of the own gravitational field of the body **m**, the condition of the effective (optimal) quantum motion is as follows:

$\frac{dF}{dt} = L \times F \times g$ ***N/s,***

where is g = 9,8 m/s^2— conversion coefficient from kg / c in N / s.

$dt = \frac{1}{L \times g} \times \frac{dF}{F}; t = \frac{1}{L \times g} \times \ln F$ *or* $t = \frac{1}{L \times g} \times \ln(ma)$**,** where:

$a = \frac{1}{m} \times \exp(t \times L \times g)$, with considering t **= 0:**

$$a = \frac{1}{m} \times (\exp(t \times L \times g) - 1) \qquad \textit{Formula 1}$$

In order to base the theory of optimal motion, need real, natural, and of course, the *optimal* system in which there is motion under the force. Such a system is the Earth itself, and bodies falling at the surface of the Earth with the same and optimal acceleration $\boldsymbol{g=9{,}8\ m/s^2}$.

Free fall acceleration g - is the intensity of the gravitational field of the Earth. If we assume, that for any mass m falling at the surface of the Earth, g pulsates optimally and with a very high frequency, in accordance with the quantization of the motion of the body (*Basic condition B of Hypothesis*), it is logically, that the change of intensity of each quantum of the motion (falling) of the body does not depend of its mass and described by the following formula:

$$a = \exp(t \times L \times g) - 1 \qquad \textit{Formula 2}$$

However, to maintain the dimensionality of the intensity of the gravitational field of the Earth - $\mathbf{m/s^2}$ introduce in the **Formula 2**, the coefficient $\frac{1}{m}$ with **m = 1 kg**. Therefore, in the future, we will describe the optimal change of the intensity of the gravitational field of the Earth with **Formula 1** for **m = 1 kg.**

Formula 1 describes the optimal change of acceleration of the quantum of the motion of the body *m*.

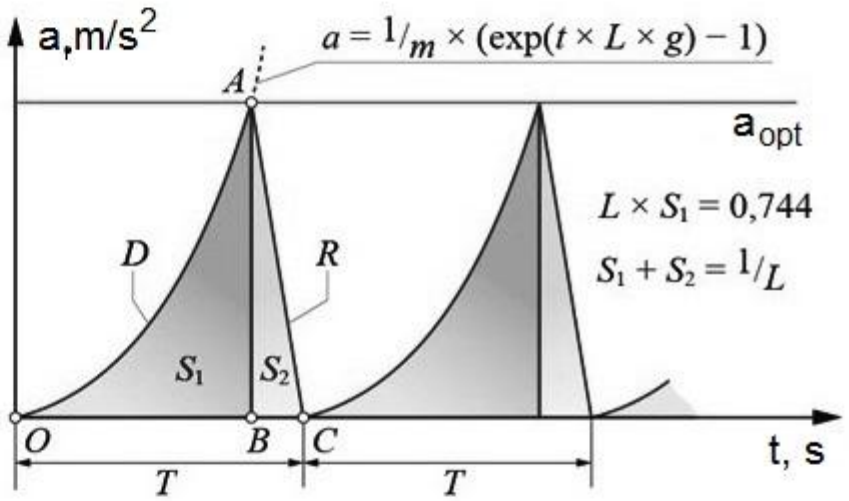

Fig.7. The optimal change of acceleration of the quantum of the motion of the body *m*.

D – deformation of the body m, R – redeformation of the body m,
T – the period of the quantum of the motion.

Schedule Formula 1 (Fig.7) takes into account:
- gravitational mechanism of the motion,
- basic conditions A and B of the Hypothesis,
- constant $L \times S_1 = 0{,}744$, the resulting of theoretical experiments.

S_1 - area of the figure ***OAB***, *natural basis* for calculating a_{opt} for various masses m, the basic part of the velocity elementary of the quantum of the motion (a fall) of the body at the Earth's surface at the optimal pulsating of the intensity of the gravitational field of the Earth- ***9.8 m/s²***;

S_2 - area of figure ***BAC***, part of the velocity elementary of the quantum of the motion (a fall) of the body at the surface of the Earth - the characteristic of inertness of the disappearance of a barrier after reaction of the own gravitational field of the body itself;

$S_1 + S_2 = \frac{1}{L}$ - area of figure ***OAC***, the velocity elementary of the quantum of the motion (a fall) of the body at the surface of the Earth.

Areas S_1 and S_2 are applied below for a theoretical experiment (Fig. 8-10).

Since the period of the quantum of the motion T is very small, it is really the body moves with constant acceleration a_{opt} , which is the best (effective) for a given mass m.

Let us try to determine the optimal acceleration a_{opt} for the mass $10\ \kappa g$, building a graph of the Formula 1 for three different assumed values L:
- 122000 s/m (rounded value of 122444 s/m, deduced above, Fig.8.);
- 122000000 s/m (Fig.9) and
- 400,000 s/m (Fig.10)

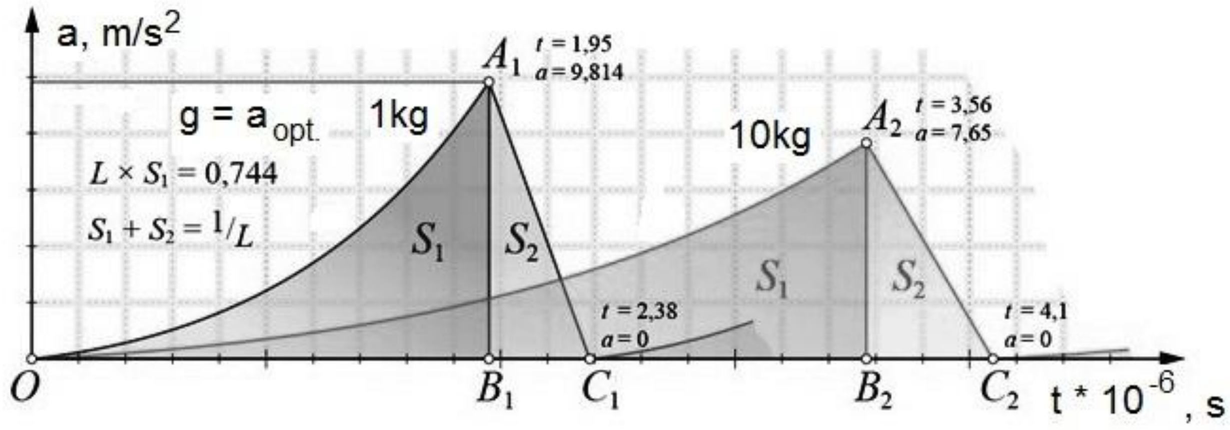

Fig.8. The optimal change of acceleration of the quantum of the motion of the body of the mass **1kg** and **10kg** at **L=122000 s/m**

At **L =122000 s/m** for the mass of **10kg** Formula 1 takes the following form:

$$\boldsymbol{a = 0,1 \times (\exp(t \times 122000 \times g) - 1)}$$

It is clear that the optimal acceleration ensured optimal force $\boldsymbol{F_{opt}}$, as the resultant of all forces acting on the body. In this case, $\boldsymbol{F_{opt.} = m \times a_{opt.} = 76{,}5\ N}$.

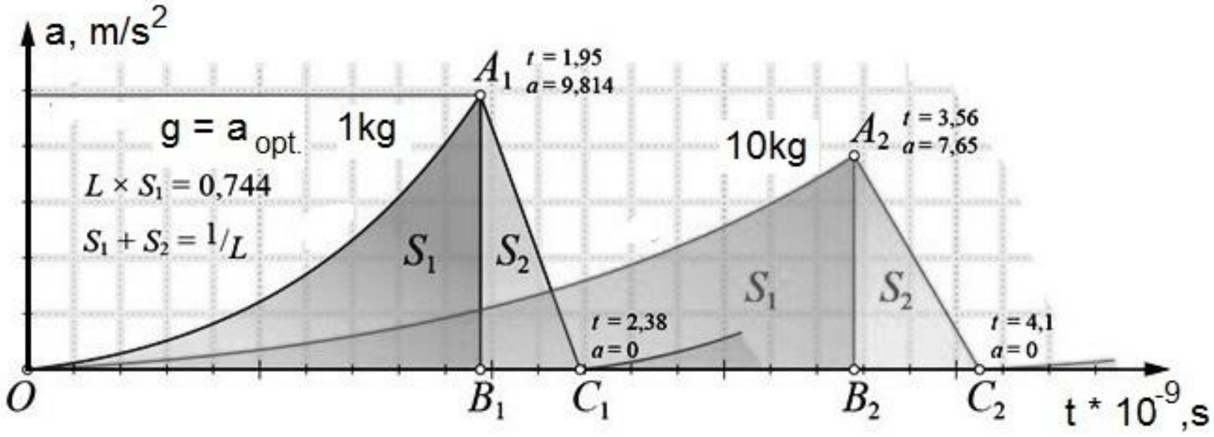

Fig.9. The optimal change of acceleration of the quantum of the motion of the body of the mass **1kg** and **10kg** at **L=122000000 s/m**

At $\boldsymbol{L \approx 122\,000\,000\ s/m}$ are considering a new natural basis $\boldsymbol{S_1}$ and via the Formula 1determine the optimal acceleration $\boldsymbol{a_{opt}}$ for the mass ***10 kg***:

$$\boldsymbol{a = 0,1 \times (\exp(t \times 122000000 \times g) - 1)}$$

Similarly, for $\boldsymbol{L \approx 400000\ s/m}$:

$$\boldsymbol{a = 0,1 \times (\exp(t \times 400000 \times g) - 1)}$$

It should be noted that the holding of this theoretical experiment, that is definition $\boldsymbol{a_{opt.}}$ for the mass of the body ***10kg*** for the three alleged values of ***L***, is produced in the following order:

1.For a given value of ***L*** is plotted the optimal change of acceleration of the quantum of the motion of the body of the mass $\boldsymbol{m=1kg(a_{opt.} = 9.8m/s^2)}$;

2.Determine natural basis $\boldsymbol{S_1}$ is graphically;

3. Is plotted the optimal change of acceleration of the quantum of the motion of the body of the mass ***m=10kg*** to area of the exponent **–** $\boldsymbol{S_1}$ and determine $\boldsymbol{a_{opt.}}$

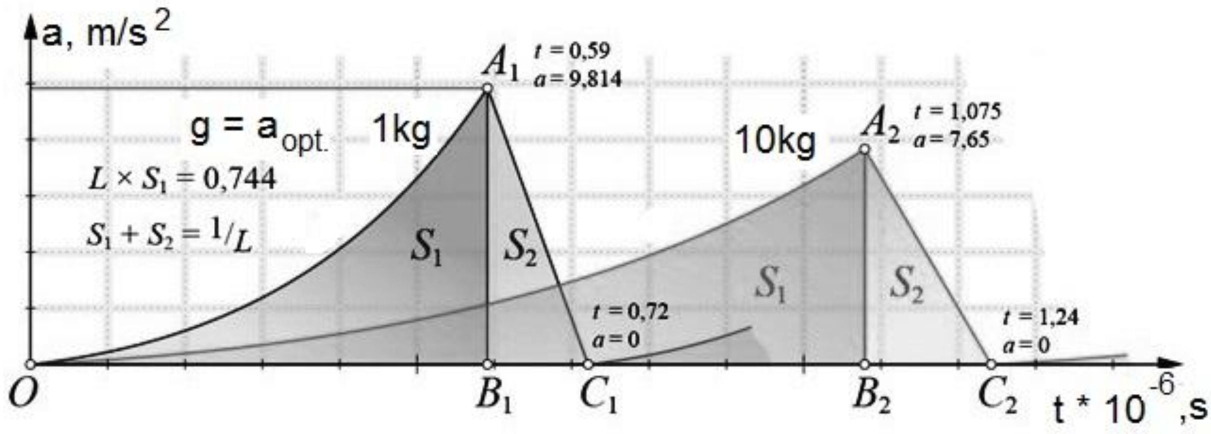

Fig.10. The optimal change of acceleration of the quantum of the motion of the body of the mass **1kg** and **10kg** at **L=400000 s/m**

Table1.Summary parameters of graphs

S_1,*m/s*	S_2, ***m/s***	$S_1 + S_2 = 1/L$, ***m/s***	***L, s/m***	$a_{опт}$ for *m*=1 *kg*	$a_{опт}$ for *m*=10 *kg*
$6{,}1 \times 10^{-6}$	$2{,}1 \times 10^{-6}$	$8{,}2 \times 10^{-6}$	122 000	9,814	7,650
$6{,}1 \times 10^{-9}$	$2{,}1 \times 10^{-9}$	$8{,}2 \times 10^{-9}$	122 000 000	9,814	7,650
$1{,}86\times10^{-6}$	$0{,}64 \times 10^{-6}$	$2{,}5 \times 10^{-6}$	400 000	9,814	7,650

Natural basis S_1 is inversely proportional to L, therefore, irrespective of real values L(it can be greater, and natural basis, respectively, smaller), the optimal acceleration a_{opt} for a given mass does not change and its always possible to determine. Thus: **For each mass *m* there is the own optimal (efficient) acceleration a_{opt}. This is the main condition of the optimal motion.**

Appropriate to apply the “Principle of the optimal motion” to movtion of the people,vehicles (both ground and air), industrial equipment during switching on, as well, the charge carriers (electrons) in electrical circuits of industrial and civil buildings, to improve the efficiency of movtion and energy savings.

Optimal motion – is the motion with optimal acceleration. This is “Principle of the optimal motion”.

The assumed applications of the theory (the principle) of the optimal movtion look in the material [4].

The principle of optimal motion divides objects into two groups:

Group X - of objects that can move with optimal acceleration;

Group Y - of objects that can move with acceleration closest to the optimal.

For convenience of consideration of *the principle of optimal motion* of various objects, moving with acceleration, look a table with the indicating the group of the object's, mass, maximum and optimal acceleration[2]. The value of L is taken equal to 1s/m, and the natural basis S_1, respectively, 0.744m/s, (we remember that $L \times S_1 =$ **0,744**).

In addition, consider the principle of the optimal motion for energy savings - is motion of the mass charge carriers (electrons) with acceleration closest to the optimal a_{opt} in electrical circuits, industrial and civil buildings . As an example, consider the electrical circuit of the household lamp. To determine the optimal acceleration in such a circuit , calculate the mass of the charge carriers:

$m_c = m_e \times n_1 = 6{,}1 \times 10^{-6}$ kg where:

$m_e = 9{,}1 \times 10^{-31}$ kg— is the mass of the electron,

$n_1 = x \times n = 67{,}5 \times 10^{23}$— the number of electrons in the electrical circuit,

$x = l \times S = 67{,}5 \times 10^{-6}\ m^3$—volume of the circuit,

$l = 45$ m— the length of electrical circuit,

$S = 1{,}5\ mm^2$—cross-sectional area of the copper wire,

$n \approx 10^{29}\ m^{-3}$—is the concentration of electrons in copper.

Determine the optimal acceleration of the mass of the charge carriers by my theory: $a_{opt} = 1550\ m/s^2$. We count a real acceleration of the mass of the charge carriers:

$a_r = v_d/0{,}005 = 0{,}1\ m/s^2$;

$v_d \approx 0.5 \times 10^{-3}$ m/s -drift velocity of electrons in the metal,

0,005 s— time of industrial-rise of the current (50 Hz) to the effective value – $I_{eff.}$(Fig.11).Ieff. Conclusion: $a_{opt} >> a_r$.

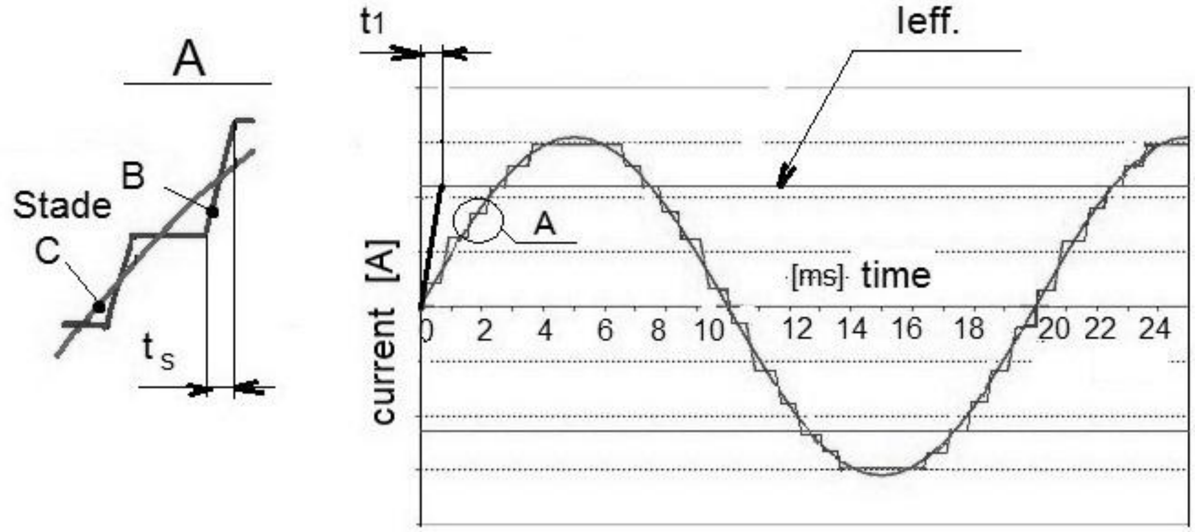

Fig.11.The principle of the optimal motion for energy savings

[2]The masses and maximal accelerations are taken from the technical characteristics of the objects. Optimal acceleration of the objects determined by our theory of the optimal motion graphically in the program Matlab 7 and in the other program for calculation and construction of the exponent.

C-sinusoidal signal,

B -modified sinusoidal signal.

Thus, the principle of optimal motion to save energy carried by using the *transmitter of the form of the signal - 220 AC/220 AC* from sinusoidal to the modified sinusoidal (Fig.11). In this converter real acceleration - v_d/t_1 closest to a_{opt}.

$t_1 = z \times t_s$,

z— number of stages of the modified sinusoidal signal with the time ***0.005s***,

t_s— time of the one step.

This transmitter operates with the computer program that takes into account:

- size-specific electrical circuit for calculating the mass of the electrons and the subsequent determination a_{opt},
- v_d/t_1 ratio the closest a_{opt}.

It should be noted that there is a converter 12 DC/220 AC for solar panels and wind turbines with an output modified sinusoidal signal. This simplifies the creation of a new transmitter for energy savings.

Experimental confirmation of the theory of the optimal movtion and the hypothesis itself

The experimental setup to confirm the theory of the optimal motion and hypothesis of the atomic (quantum) motion (Fig.12) is a DC motor (6V),with the test mass (***m*** = 0,54 kg) on the its shaft.

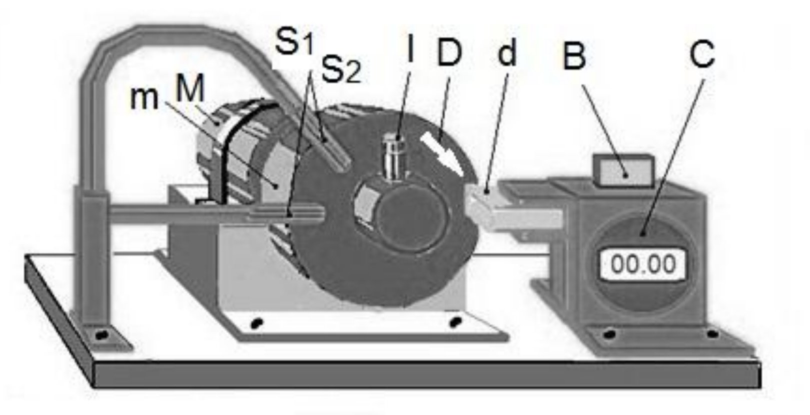

Fig.12.The experimental setup to confirm the hypothesis

m- the test mass (0.54 kg), M – DC motor (6V), S1,S2 - inductive sensors, I – the indicator of rotation of mass (m), D – directing of rotation of mass (m), d- the braking system of mass (m), B- switch of electric motor, C - electronic stopwatch (0.01s).

The purpose of the experiment - to get the maximum efficiency of the motor at the starting state at the optimal acceleration of the mass m.

The experiment is conducted in a starting state by briefly pressing the switch of the motor at various voltages U at the terminals of the motor (4 V to 12 V steps). Herewith the indicator of rotation of the mass ***m*** moves is accelerated, crossing the electromagnetic fields of inductive sensors and recording the time of the passage way between the sensors, **0.02 m.**

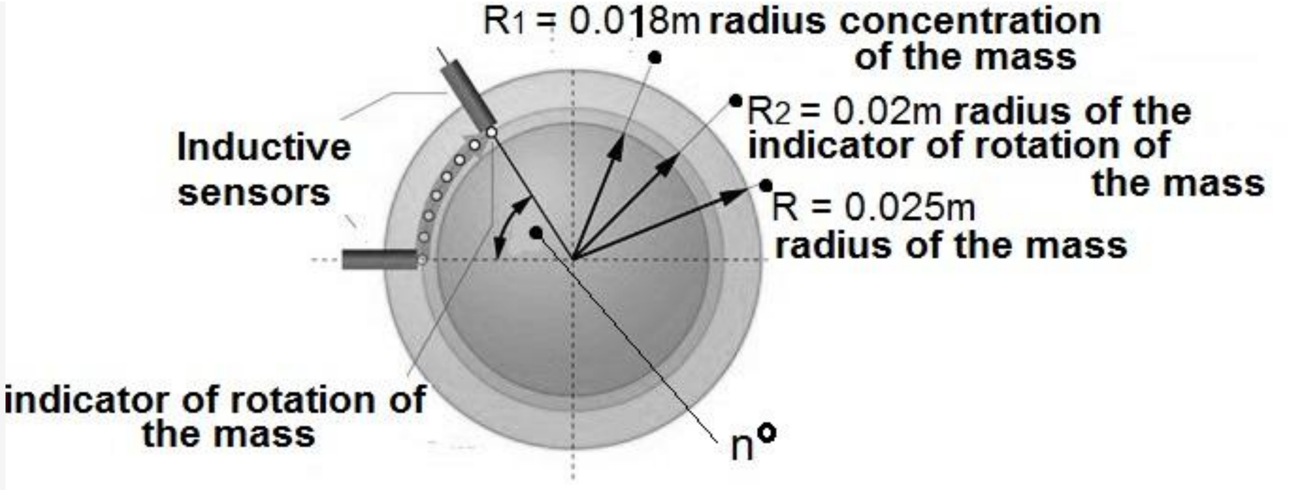

Fig.13.Motion of the indicator of rotation relatively to the inductive sensors.

In the experimental setup provided the braking system of mass, which does not allow the indicator of rotation again cross the electromagnetic field of inductive sensors.

The experimental results are presented in Table 2. Basis for the calculation of the table is the time **t** of the passage of area **0.02 m** an indicator of rotation of the mass ***m*** between inductive sensors at different voltages on the motor. Measurement of this time made by the electronic stopwatch (**0.01 s**).

For the analysis the table of the experiment calculate the time **t** at the optimal acceleration of mass **m = 0,54 kg**. Thus, optimal acceleration $\mathbf{a_{opt.} = 11\ m/s}2$ determined graphically by $\mathbf{S_1 = 6{,}1 \times 10^{-6}\ m/s}$; **L = 122000 s/m** (see above). This is the optimal acceleration is the linear acceleration of the center of concentration of the mass ***m***.

Table 2

t, *s*	**Neff.,** *Wt*	**Nexp.,** *Wt*	**U,** *V*	**Ist,** *A*	**Efficiency**
0,06	2,0	94,86	6,16	15,4	0,020
0,08	0,8	79,50	5,64	14,1	0,010
0,09	0,6	67,60	5,20	13,0	0,009
0,10	0,4	43,68	4,16	10,5	0,009

In the table of experiment:

t- the time of the passage of area **0.02 m** an indicator of rotation of the mass ***m*** between inductive sensors;

$N_{eff.} = m \times a \times S/t = 2m \times S^2/t^3 = 4{,}32 \times 10^{-4}/t^3$ – the effective power at the starting state of the motor;

$N_{exp.}$ **= U × Ist.** - the expended power at the starting state of the motor;
U - voltage;
$I_{st.} = U/R_{anch.}$ - the starting current;
$R_{anch.}$= 0.4om - the resistance of the turn of anchor of the motor;
Efficiency - efficiency of the motor at the starting state.

The test mass is performed in the cylindrical form. Radius R_1 concentration of mass ***m*** - is the radius of an imaginary circle whose area is equal to half the entire area of the base of the cylinder: $\pi R^2/2=\pi R_1^2$, where $R_1=0{,}018$ **m.**

Calculation of the acceleration of the indicator of rotation of mass ***m*** (Fig.13) $a_{opt.ind.}=12{,}1 m/s^2$ at the optimal acceleration of mass ***m***, which allow to determine the time $t \approx 0{,}06$ s:

$$\frac{2\pi R_1 \times n^\circ}{360^\circ} = \frac{a_{\text{opt}} \times t^2}{2}$$

$$\frac{2\pi R_2 \times n^\circ}{360^\circ} = \frac{a_{\text{optind}} \times t^2}{2}$$

where:

$$\frac{R_1}{a_{\text{opt}}} = \frac{R_2}{a_{\text{optind}}}$$

i.e: $R_1 \times a_{\text{opt.ind}} = a_{\text{opt}} \times R_2$

where: $a_{\text{opt. ind}} = a_{\text{opt}} \times R_2/R_1 = 12{,}1\ \text{m/s}^2$

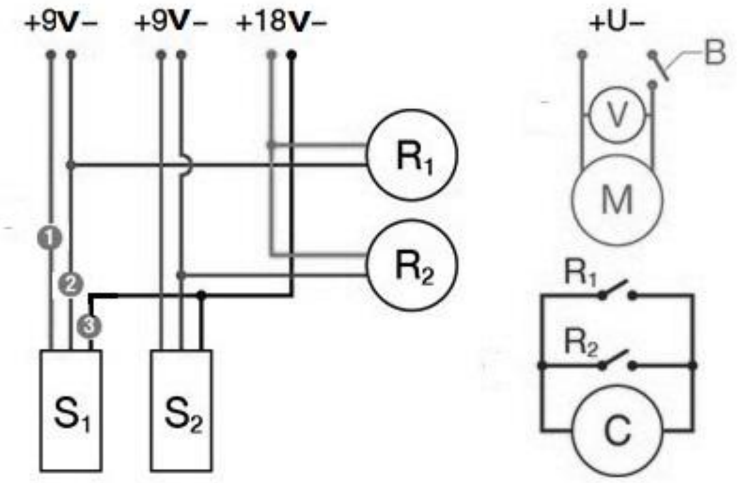

Fig.14. Electric scheme of the experimental setup

M – DC motor (6V), S1,S2 - inductive sensors, B- switch of electric motor, C - electronic stopwatch (0.01s), R_1,R_2 – relay, U - DC power supply with a step voltage regulator, 4-12 V, V – voltmeter (10V), wires 1 and 2 - the power supply to the inductive sensors, wires 2 and 3 the power supply to relay when crossing the electromagnetic field of inductive sensors (contacts of the inductive sensors are normally open).

Conclusion: The experiment confirms the increase of the efficiency of the motor (at the starting state) when approaching to the optimal acceleration of the test mass ***m***.

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