THE RISE OF THE QUANTOMOBILE THEORY

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Abstract

Introduction: The progress of science at the turn of the 21st century has made it possible to create new quantum engines (QEs), powered by physical vacuum energy. The thrust force generated by QEs can be applied to the vehicle's body directly, with no transmission required. This will completely transform the transportation industry: the traditional cars will be upgraded with QEs and thus converted into quantomobiles. Ahead of this major transition, we believe it necessary to outline the quantomobile theory. **Methods:** We formulate and review the key concepts of the quantomobile theory from the systemic, philosophical standpoint, drawing analogies from the existing automobile theory. We also present models of this hypothetical vehicle's components and functions. **Results:** The study results in the following: a structure of the quantomobile theory; an overview of the vehicle's hypothetical configuration, its constructive and operational features, force balance specifics, and movement patterns, along with various aspects of acceleration time, off-road performance, ease of operation, and other features; an analysis of the vehicle's thrust and speed characteristics that are shaped by the QE thrust. The vertical component of the thrust vector is sufficient both for hovering and pressing down the vehicle. This enables both the airborne and underwater quantocraft modes, transforming the quantomobile into an all-purpose, multi-modal vehicle (multi-modal quantomobile, or MMQ). **Discussion:** The quantomobile theory, even on the purely hypothetical level, will be of use at the early stages of designing quantomobiles and their subclasses, conducting R&D, developing infrastructure, and supplying the transportation industry with the equipment and HR required.

Keywords

Quantum engine, quantomobile, force balance, airborne quantocraft, underwater quantocraft, multi-modal quantomobile (MMQ), quantomobile theory.

Introduction

By the early 21st century, breakthroughs in physics and the progress of science and technology had created the necessary prerequisites for the emergence of entirely new propulsion systems: fuel-free quantum engines (QEs). Putting certain theories — such as V.S. Leonov's Superunification Theory (Leonov, 2002, 2010, 2018) — into practice will make it possible to generate energy from the physical vacuum. This new capability will extend to vehicles' power units.

A new generation of vehicles with quantum engines (QEs) — quantomobiles — will replace automobiles. We introduced and rationalized the usage of the "quantomobile" term in a previous study (Kotikov, 2018e).

The principal difference between a QE and an ICE is that the QE will generate a vector-based propulsive force, or thrust, applicable to the vehicle's body directly, with no transmission required (Kotikov, 2018c, 2018d, 2018g, 2019d; Leonov, 2010, 2018). The thrust vector's angle creates a vertical component, suitable for either hovering the vehicle (up to the point when it transforms into an airborne quantocraft) or pressing it down (so it can function as an underwater quantocraft). We have conducted several studies (Kotikov, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2018g, 2019a, 2019b, 2019c, 2019d, 2019e, 2019f, 2019g, 2019h, 2020a, 2020b) where we elaborated on several aspects of this subject, with respect to both vehicles and lifting machinery.

The introduction of QEs will revolutionize the entire range of research insights and equipment used in the transportation industry: the traditional cars will be upgraded with QEs and thus converted into quantomobiles. This calls for outlining the quantomobile theory. It will be of use at the early stages of designing quantomobiles and their structural subclasses, conducting R&D, developing infrastructure, and supplying the transportation industry with the equipment and HR required.

The concepts outlined below are based on 16 of our research papers, thus presenting a summary of

DOI: 10.23968/2500-0055-2020-5-4-74-81

what we have achieved thus far. It bears pointing out that, while our research has received a critical response, we do not yet possess any information as to whether other researchers have published their own works featuring either similar concepts or the quantomobile theory as such.

Creation of the general quantomobile theory structure

Building upon the achievements of the automobile theory over the past century, as well as bearing in mind the discovery, conceptualization, and the need for exploration in the realm of the physical vacuum, we deem it useful to go over the following aspects of the quantomobile theory:

1. Subject matter of the quantomobile theory.
2. Concepts of the Superunification Theory and their application in transport.
3. Conceptual foundation of quantum engines.
4. Quantomobile structural design.
5. Quantomobile thrust and speed characteristics.
6. Quantomobile braking dynamics.
7. Quantomobile aerodynamics.
8. Ease of operation.
9. Stability.
10. Off-road performance.
11. Maneuverability.
12. Energy efficiency.
13. Safety.
14. Infrastructure and maintenance features.

We have already laid down the conceptual foundations for the above, in varying degrees of detail. The first five items on the list above have been covered more extensively. We have published a number of papers on the subject (Kotikov, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2018g, 2019a, 2019b, 2019c, 2019d, 2019e, 2019f, 2019g, 2019h, 2020a, 2020b). The other items have been touched upon briefly, as essential elements of our theory's structure.

1. Subject matter of the quantomobile theory. The term "quantomobile" was first introduced in our study (Kotikov, 2018e). This term denotes a self-propelled vehicle and/or lifting machine that is powered by a quantum engine and can be used for moving cargo, passengers, special equipment, and other objects.

The *quantomobile theory* is a discipline that studies the mechanics of the quantomobile, the way it interacts with its main support surface (ground) and additional surfaces (air and water), and its structural and operational parameters.

The theory studies the innovative vehicle that is supported by wheels, sleds, or other structural elements suitable for overground movement, and is also capable of hovering above ground (in the airborne quantocraft mode) or pressing down and converting into an underwater quantocraft (quantomarine). Vehicles of this type can be described as multi-modal vehicles (MMVs) (Military.com, 2013; Zhu, 2009). In our case, the MMV is a multi-modal quantomobile (MMQ).

The subject matter of the quantomobile theory is a set of principles that describe the mechanics of MMQ's movement, as well as its interaction with the ground, air, and water, and operational properties.

The goal of the quantomobile theory is to provide a mathematical description and simulate the motion mechanics of the MMQ as a complex system, as well as demonstrate how the vehicle's mechanisms and systems function and shape its operational properties.

Just like the quantomobile has inherited a variety of properties from the traditional automobile, so has the quantomobile theory borrowed a certain set of concepts from the traditional automobile theory. Being an MMQ, the quantomobile also takes certain properties from aircraft, waterborne vessels, and submarines, and can be described with relevant terms and concepts.

2. Concepts of the Superunification Theory and their practical application. The Superunification Theory (Leonov, 2010) considers the process of space-time quantization. This process involves filling space with quantons. A quanton consists of four quarks: two electric and two magnetic, which form a tetrahedron with two orthogonal dipoles. Those two dipoles form an electromagnetic quanton quadrupole. The four quarks making up a quanton combine electricity and magnetism in the form of a unified electromagnetic substance, the carrier of which is the four-dimensional quantized space-time (QST). The physical vacuum in the universe is filled with moving quantons, likened to a "boiling broth". The interaction between the quantons depends on their proximity, the charge sign of the adjacent quarks in neighboring quantons, and the orientation of dipole axes (Kotikov, 2018g; Leonov, 2010).

The equilibrium state of a QST fragment implies that the resultant vectors of axial forces of dipoles equal zero in any direction. The "intrusion" of free quarks into a fragment perturbs the electromagnetic field, bending it relative to the initial equilibrium state (in this case the resultant force zero vector acquires magnitude and direction). By controlling the introduction of free quark sets, we can manipulate changes in the vector (Leonov, 2010).

According to the results of experimental studies conducted by V. S. Leonov, external fields can interact with the QST structure, resulting in stable anti-gravity effects. We can consider the outer space as an elastic super energy-dense medium having an electromagnetic structure with overall support and sufficient energy. We should learn how to interact with the medium and manage this interaction (Leonov, 2002, 2010).

3. Conceptual foundation of quantum engines. The rotation of the electromagnetic quadrupole generates the Lorentz force, which, in turn, creates the axial thrust. During the process, the quadrupole "drills" into the surrounding medium and thus moves forward, not unlike a propeller (Leonov, 2002, 2010, 2018).

If the quanton is forced to rotate, this generates the field thrust, causing it to move through space. The physics of the process is based on the interaction of fields (the rotating field of the quadrupole and the sign-alternating field of the quantized medium). In other words, QEs are engines where the thrust is caused by field interaction.

To create thrust without the ejection of reactive mass, it is necessary to switch over to the open quantum-mechanical systems, treating QST as an elastic quantized medium. Consequently, it is possible "to push away" from such an elastic quantized medium, thus generating thrust. This does not contradict Newton's third law. As per the Superunification Theory, a QE is an open quantum-mechanical system — as opposed to an internal combustion engine (ICE), which constitutes a closed thermodynamic system (Leonov, 2010, 2018).

4. Quantomobile structural design. Fig. 1 presents a layout of a quantomobile with two QEs (Leonov, 2010). A single QE unit has the capacity for combining a vertical and horizontal thrust and adjusting the thrust direction. It will also be possible to install several QEs in a single vehicle, each with its own purpose (such as ensuring buoyancy, generating a horizontal thrust, creating a maneuvering impulse, etc.)

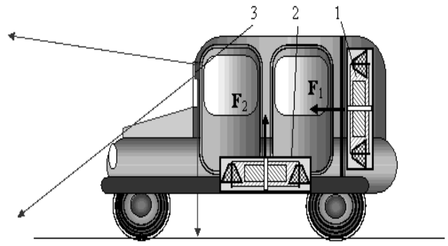

Figure 1. Off-road vehicle with an anti-gravity cushion, powered by two QEs: 1 — a QE with a horizontal thrust F_1; 2 — a QE with a vertical thrust F_2; 3 — a scanning radar (Leonov, 2010).

5. Quantomobile thrust and speed characteristics (TSC). TSC are the key features of the quantomobile, and describing and rationalizing them is a top priority, tied to the fundamental goal of researching the vehicle's capacity for being propelled by QE thrust. We believe that the following aspects of TSC analysis must be considered first:

5.1. Energy flow direction and the creation of the vehicle's force balance. We review the conceptual basics of these aspects in (Kotikov, 2018c, 2018d, 2018g, 2019e).

5.2. Features of the quantomobile's power unit. This aspect is represented in (Kotikov, 2018c, 2018d, 2018g, 2019c, 2019e, 2019f).

5.3. Quantomobile modes. In (Kotikov, 2019a), we study the vehicle's overland modes, as well as its capacity for hovering if the vertical thrust component is prominent enough. In this paper, we are going to provide a more in-depth list of MMQ modes, including waterborne and underwater modes (Table 1). Note that G_q is the quantomobile's weight.

Table 1. Multi-modal quantomobile (MMQ) operation modes

No.	Operation mode	Environment	*Vertical component of the thrust* F_{Tz}	Typical features
1	Longitudinal vertical motion	air	$F_{Tz} > G_q$	Vertical breakoff possible
2	Longitudinal boundary motion, full hovering	air	$F_{Tz} = G_q$	Horizontal motion above ground
3	Longitudinal motion, partial hovering	Air-ground	$0 < F_{Tz} < G_q$	Thrust vector optimization possible
4	Longitudinal motion, no hovering	Air-ground	$F_{Tz} = 0$	Traditional automobile mode
5	Longitudinal motion along the shallows (up to the floor)	Air-ground-water	$F_{Tz} = 0$	Road resistance increases substantially
6	From the floor to the water line	Air-ground-water	$F_{Tz} = 0$	Resistance shifts from ground to water
7	Floating above the water line	Air-water	$F_{Tz} = 0$	Boat / motor boat mode
8	Submerged from the water line to the roof	Air-water	$F_{Tz} < 0$	The thrust presses the vehicle down, converting it into a submarine
9	Submerged from the roof to 0.5 L_{body}	Water	$F_{Tz} < 0$	Underwater quantocraft (quantomarine) mode, with intensive wave formation
10	Submerged deeper than 0.5 L_{body}	Water	$F_{Tz} < 0$	Underwater quantocraft (quantomarine) mode, no waves

DOI: 10.23968/2500-0055-2020-5-4-74-81

5.4. Course control. The key idea is to vary the magnitude and direction of the thrust vector in the MMQ pitch plane (Kotikov, 2019a, 2019c, etc.). See Fig. 2.

If it is technically possible to retain the β angle of the thrust vector $\boldsymbol{F}_T$ in the longitudinal vertical plane, then the vector can be split into two components, $\boldsymbol{F}_{Tx}$ and $\boldsymbol{F}_{Tz}$. Then, the first and second quadrants of its coverage area will experience hovering, with an upward force $\boldsymbol{F}_{Tz}$; while the third and fourth quadrants will experience pressing-down by a downward force $\boldsymbol{F}_{Tz}$.

The vehicle hovers in modes 1–3 of the MMQ (Table 1). Modes 8–10 of the MMQ are characterized by the vertical component of the thrust vector that presses the vehicle down.

As the vehicle's buoyancy reduces road resistance and helps it hover but also requires high levels of power consumption, the movement trajectories need to be optimized.

5.5. Quantomobile acceleration time: this aspect depends on the MMQ force balance and the reserves of thrust that remain after ensuring that the quantomobile moves smoothly. It is possible to produce MMQs with different acceleration capacity, but the maximum acceleration will be restricted by biomechanical limits. We should note that, aside from the traditional horizontal acceleration, vertical acceleration should also be taken into account.

5.6. Quantomobile hovering in the quantocraft mode. This is operation mode 1 (Table 1). The requirements for this mode are: ensuring good aerodynamics and keeping the carrying wheels inside the vehicle's outline.

5.7. Modes 6 and 7 are waterborne modes. In these modes, the vehicle's floor must be sustained by good hydrodynamics along the water line, and the presence/absence of carrying wheels must be optimized.

5.8. Pressing down and transforming the quantomobile in a quantomarine. This corresponds to modes 8–10. The requirements for this mode are: ensuring good hydrodynamics and keeping the carrying wheels inside the vehicle's outline. Aside from the F_{Tz} value, an important aspect of controlling the vertical component of the MMQ trajectory is the adjustment of the vehicle's trim. It is vital to remember that, when a vehicle is submerged to an equivalent of half its body length or more, resistance decreases substantially, as there is no more wave formation (Wikipedia, 2017).

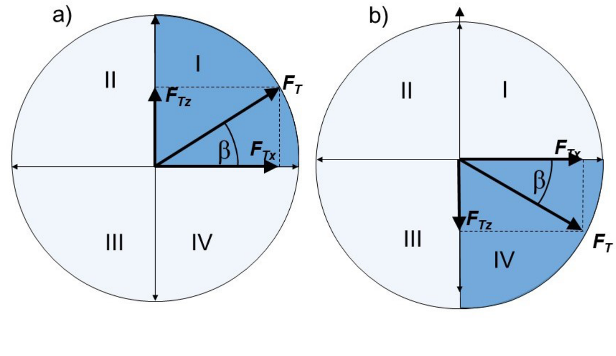

Figure 2. Circular diagram of the possible thrust vector $\boldsymbol{F}_T$ directions: a) hovering vehicle variation; b) pressed-down vehicle variation

5.9. Energy flow direction and the creation of the vehicle's force balance.

As we transition from the automobile to the quantomobile, it would be useful to compare the generation of the respective thrust forces: P_T (automobile) and F_T (quantomobile). See Fig. 3. A quantomobile has no transmission, driving wheels, or suspension elements responsible for shifting the thrust force. This simplifies its structural layout (Kotikov, 2018c, 2018d, 2018g).

Fig. 4 provides the full thrust balance picture (Kotikov, 2018c, 2018d, 2018g). The area of the automobile's thrust forces is highlighted in yellow. The area highlighted in blue (ranging from dark to light) shows the quantomobile thrust values F_T. We can see that the vehicle possesses excellent force and power capacity. The different shades of the highlights roughly correspond to the QE force capacity; note that the limits for the regulatory characteristics are scalable from 1 to 4.

5.10 Quantomobile force balance equation

Buoyancy is ensured by the capacity for rotating the thrust vector F_T within the pitch plane. In (Kotikov, 2019a) we show that it is fundamentally incorrect to represent the thrust F_T as an arithmetic sum of scalar values representing the horizontal thrust F_{Tx} and the vertical thrust F_{Tz}. Therefore, quantomobile balance differs from that of a traditional car. According to (Kotikov, 2019a), the quantomobile force balance equation is as follows:

$$F_T{}^2 = F_{Tx}{}^2 + F_{Tz}{}^2 = \left(P_f + P_{w.x} + P_{j.x}\right)^2 + \left(P_{w.z} + P_{j.z} + P_g\right)^2 = \Bigg(f_{к0}\,(1 + f_{кV} \cdot V_x^2) \cdot (G_q - F_{Tz})\Big|_{F_{Tz} \le G_q} + k_{w.x} \cdot S_{front} \cdot V_x{}^2 + \frac{G_q}{g} a_x \cdot (1 + \delta_w)\Bigg)^2 + \left((k_{w.z} \cdot S_{plan} \cdot V_z{}^2 + \frac{G_q}{g} a_z)\Big|_{F_{Tz} > G_q} + \min(F_{Tz}, G_q)\right)^2, \tag{1}$$

where F_T, F_{Tx}, F_{Tz} is the thrust and its respective coordinate components, N; P_f is the resistance against the rolling of wheels, N; $P_{w.x}$ is the wind resistance against horizontal motion, N; $P_{j.x}$ is the resistance against horizontal acceleration, N; $P_{w.z}$ is the wind resistance against vertical motion, N; $P_{j.z}$ is the resistance against vertical acceleration, N; P_g = min (F_{Tz}, G_q) is the part of the thrust's vertical component that neutralizes the hovering vehicle's γ share of the gravity force (γ = F_{Tz} / G_q), N; f_{w0} is

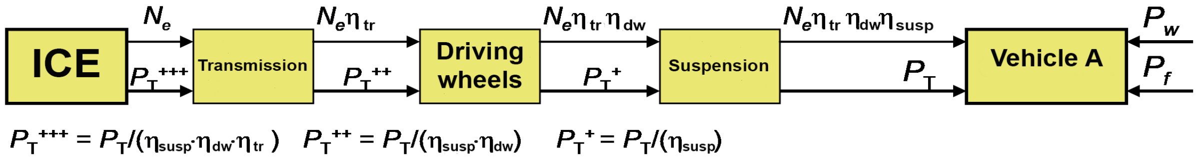

Figure 3. Comparison of thrust force generation in an automobile (P_T) and quantomobile (F_T)

the resistance coefficient for driven wheels when the speed approaches zero and F_{Tz} = 0; f_{wV} is the speed coefficient of resistance against the rolling of driven wheels, s²/m²; V_x is the current speed of the vehicle's longitudinal movement, m/s; G_q is the quantomobile's weight, N; $k_{w.x}$ is the vehicle's horizontal wind shape coefficient, N×s²/m⁴ ; S_{front} is the vehicle's frontal area, m²; g is gravity acceleration, m/s²; a_x is the vehicle's longitudinal acceleration, m/s²; δ_w is the inertia coefficient for rolling wheels; $k_{w.z}$ is the vehicle's vertical wind shape coefficient, N×s²/m⁴; S_{plan} is the vehicle's size in plan view, m²; V_z is the vehicle's vertical speed, m/s; a_z is the vehicle's vertical acceleration, m/s²; $|F_{Tz} \leq G_q$ is the permissible value range for F_{Tz} in the pressing-down or partial hovering mode (without the vehicle being lifted off the ground); $|F_{Tz} > G_q$ is the permissible value range for F_{Tz} in the full hovering mode.

If we apply equation (1) to waterborne and underwater modes 6–10, the last member of the equation, min(F_{Tz}, G_q) must be replaced with the following: (F_{press} – G_q), which represents the submerging force F_{sub} (Wikipedia, 2017).

6. Quantomobile braking dynamics. While

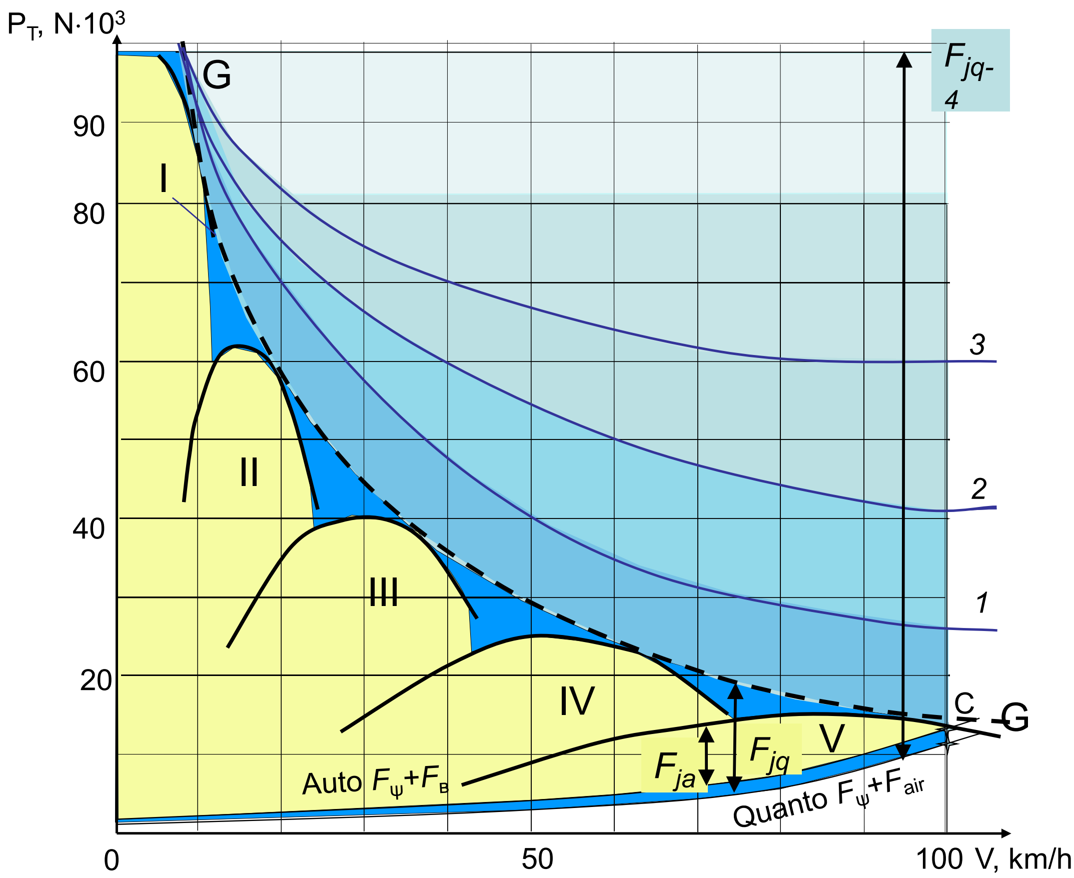

Figure 4. Thrust balance of an automobile (yellow) and quantomobile (blue): GG — a hyperbola enveloping the automobile's thrust force diagrams; I…V — the transmission speeds; 1…4 curves — the possible ways in which the QE can exhibit its limit regulatory characteristics

DOI: 10.23968/2500-0055-2020-5-4-74-81

quadrants I and IV (Fig. 2) are meant to reflect the vehicle's uniform and accelerated translational motion overland or through the air, quadrants II and III show the vehicle's slowing down and braking processes, as seen from the QE, with the backward rotation of the thrust vector. A combination of the horizontal ($\boldsymbol{F}_{Tx}$) and vertical ($\boldsymbol{F}_{Tz}$) thrust components might also facilitate smoother braking.

The emergency braking system will be more effective: a vertical force vector will put pressure on wheels to maintain roadholding during corner braking, with optimal weight distribution. The complex downhill assist systems (ABS, etc.) will become obsolete. All a quantomobile needs is rotating the thrust backward and regulating its magnitude (Kotikov, 2018b, 2018f).

7. Quantomobile aerodynamics. A quantomobile has no drive shafts or drive housings, thus making room for a clad floor and reducing air and water resistance.

The specific features of the vehicle's body, floor, and tail (both for air and for water) require further study.

8. Ease of operation. Lateral motion control. There is a need for assessing this feature's efficacy, in tandem with course control, ease of operation, off-road performance, and maneuverability.

The introduction of a jointed QE unit enables wheel steering, which adds to ease of operation. Lateral motion and maneuvering (changing the vehicle's position in relation to the pitch plane), both through water and through air, will become possible thanks to the lateral thrust component.

If the quantomobile supports a joint-based QE or alternatively, if the thrust vector outlines the entire three-dimensional space (i.e. that the thrust has a lateral component), this will create a centripetal force that will counter the centrifugal force along the raised curve. This is useful for high-speed motorways. The rigid angle of the path (adopted for a certain speed level) may be replaced with a flexible transverse thrust component, easily adjustable depending on the vehicle's speed.

9. Stability. If the friction is insufficient, the vertical vector may press down on the wheels. Quantomobiles should be able to move over steep hills. A "rigid" thrust will be able to significantly stabilize the vehicle in the waterborne mode, even if the waves are strong.

10. Off-road performance. Good off-road performance is ensured by a clad floor. The quantomobile is capable of traveling uphill at a steep angle, without having to rely on high-speed dynamics. Hovering will also contribute to improving performance in extremely poor off-road conditions.

11. Maneuverability. Wheels turn around the vertical axis more easily and simultaneously on all axles. Quantomobiles can still require an independent drive for wheels, to facilitate maneuvering.

12. Energy efficiency. The QE allows the vehicle to set off with consistent thrust. This will make it possible to use its power capacity to the max, avoiding the losses typical of internal combustion engines. Energy is recovered during cyclic movement.

13. Safety. Noise level: the wheels make less noise in the driving mode. No power drive elements means no vibration. The means of cooling the QE are yet to be determined. The heat impact on the vehicle and the need for heat protection merit further study. This vehicle will produce fewer chemical emissions. At this point, it is hard to predict the impact of high-frequency QE fluctuations.

14. Infrastructure and maintenance features. The vehicle will not need refueling on a regular basis. The entire system of vehicle maintenance will change. Changes in roads and traffic regulations will be observed as well.

Conclusion

We have now summarized the structure of the multi-modal off-road quantomobile, or MMQ, theory. Most of the concepts and sections are the legacy of the automobile theory concepts. Even though the theory so far remains hypothetical, its structure still could (and should) receive more functional additions. It also requires conceptual additions from aircraft building, rocket science, and submarine theory.

As we gather more materials on how this innovative vehicle may be used in practice, the demand for the quantomobile theory will grow.

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DOI: 10.23968/2500-0055-2020-5-4-74-81

ВОЗНИКНОВЕНИЕ ТЕОРИИ КВАНТОМОБИЛЯ

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Аннотация

Продвижение научно-технической мысли к началу 21 века обозначило возможность создания квантовых двигателей (КвД), использующих энергию физического вакуума. КвД генерирует тяговую силу (траст), которую можно непосредственно, исключая трансмиссию, прикладывать к корпусу транспортного средства (ТС). Эта особенность приведёт к перевооружению транспортной отрасли – классический автомобиль при установке на нем КвД трансформируется в квантомобиль. В преддверии этого преобразования появляется необходимость формирования теории квантомобиля. **Методы:** С системных позиций, на базе философского осмысления, с привлечением аналогий по теории автомобиля, моделирования компонент и активностей гипотетического ТС сформированы и рассмотрены основные концепции теории квантомобиля. **Результаты:** Построена структура теории квантомобиля. Рассмотрена возможная конфигурация этого ТС, его конструктивные и эксплуатационные свойства, особенности силового баланса, варианты движения, аспекты приемистости, проходимости, управляемости, других свойств. Подвергнуты анализу тягово-скоростные свойства ТС, формируемые под действием трас та КвД. Вертикальная компонента вектора траста может обеспечить как вывешивание, так и поддавливание экипажа, что позволит реализовать как режим квантолета, так и режим квантомарины, и таким образом сформировать всесредный мультимодальный квантомобиль (Multi-modal quantomobile (MMQ)). **Обсуждение:** Теория квантомобиля, даже на гипотетическом уровне, будет небесполезной при раннем формировании типажа квантомобилей, их подклассов, совокупности НИОКР, развития инфраструктуры, технической и кадровой подготовки транспортной отрасли.

Ключевые слова

Квантовый двигатель, квантомобиль, силовой баланс, квантолёт, квантомарина, мультимодальный квантомобиль (ММК), теория квантомобиля.