

Critical analysis of new equation of the wheel machine motion

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Abstract. The article is concerned with the discussion between the author of a new equation of the wheel machine motion who is the doctor of technical science, professor G I Mamiti and his opponents. The discussion continues over a year. The opponents note that the initial hypothesis taken as the basis at development of the new equation is incorrect and unreasonable by consideration of process of reduction of forces influencing a car body to contact of driving wheels with the road. As a result, large mistakes can take place when using this equation for calculations of dynamic properties of the cars. Four doctors and three candidates of technical sciences have expressed negatively about the new equation. Nobody in the central technical press has expressed positively. Therefore, it has been offered to finish a discussion currently.

Technical magazine «Automobile Industry» (Russia) organized the discussion about of the new equation of wheel machine motion the author of which is professor Mamiti G I from Gorsky Agrotechnical University (Vladicaucasus). The new equation is based on use of a wrong hypothesis of transfer to driving wheels of the moments which affects the case in the longitudinal direction from resistance forces the movement on rise, air resistance, from forces of inertia and forces from a trailer. Classical equation of automobile motion without of driving wheels sliding is given below [1]

$$F_T - \delta m_a a_x - G_a(f \cos \alpha + \sin \alpha) - k_w A_m V^2 - F_{cx} = 0, \quad (1)$$

where F_T – drag force on driving wheels; δ – calculation coefficient of revolving mass; m_a – mass of automobile; a_x – acceleration of automobile direct motion; G_a – weight of automobile; f – coefficient of rolling resistant; α – angle of automobile motion on ascent; k_w – coefficient of air resistant; A_m – middle square of automobile; V – speed of air motion relative of automobile; F_{cx} – horizontal part of force on tow.

The original choice of the new equation of balance of force which was used by the author for measurement of process of transformation of force influencing a car body to contact of driving wheels with the road causes special coefficients of type $(h - r)/r$ [2, 3, 4], in which h_g – height of position from surface of road of the automobile center mass; h_w – accordance height of position point of sum air resistant; h_c – height of position action point horizontal part of force on tow; r – wheel radius:

$$F_T - \delta m_a a_x (h_g - r)/r - G_a f \cos \alpha - G_a \sin \alpha (h_g - r)/r - k_w A_m V^2 (h_w - r)/r - F_{cx} (h_c - r)/r = 0, \quad (2)$$

But even simple researches of this equation lead to the conclusion that any force which we can use doesn't show a resistance of the machine motion, if to do $h = r$ (or $r = h$), because in this case corresponding coefficient becomes equal to zero. It is clear, it is impossible in real life, so in his later mathematical works G I Mamiti [5] was forced to transform this equation by replacing of showed coefficients $(h - r)/r$ on h/r .

However there are some new difficulties: because almost every real wheel machine has $h > r$. All forces of resistance in new equation turn out to increase essential in comparison with classical equation. For example, for the bus with wagon body, which usually has high situation center of mass h_g and sail center h_w ($h_g \approx h_w = 1,3-1,6$ m) and typical wheel radius 0,5 m coefficient of increase will be 2,6-3,2. As a result, according to the new theory of the wheel car, moving maximum engine power for achievement of necessary maximum speed will also increase by 2-3 times. According to the



classical theory, the rated size of the maximum engine power will be well-coordinated with the maximum engine power of the real tire.

Understanding that this essential lack of its new work seriously undermine the author's authority, G I Mamiti corrected his new equation for the third time: he implemented the method of longitudinal transformation of forces only to force of air resistance without any reason. So, coefficient h/r in new variant of equation remained only at force of air resistance:

$$F_T - \delta m_a a_x - G_a(f \cos \alpha + \sin \alpha) - k_w A_m V^2 (h_w / r) - F_{cx} = 0. \quad (3)$$

To prove correctness of such decision he referred to practice of construction of a race car [5, 6]. Really, for low sitting machines as famous «Formula-1» new equation gives minimum mistake in calculations in comparison with more correct calculations with the help of classical equation. The matter is that for machines of this class it is near real $h_w \approx r$ and if to take into consideration this equality in third generation of a new equation of motion, we will receive the classical equation (1) of force balance (3), which is used very widely in calculations of wheel machines dynamic in every days engineer practice. Influence of a high-rise action pointed of equal force of air longitudinal resistance will be fiction because there is no parameter h_w in that equation.

Now it is clear, that there is no sense in new equation. Especially, because it does not give correct calculation results for usual machines, when mistakes can reach 100-150% [1]. The cause of error consists in a wrong basic hypothesis about the transfer moments to driving wheels from action on mass resistance forces the movement on rise, air resistances, from forces of inertia and forces to leave a trailer. Nobody used the procedure called by the author as a new equation «leading of resistance forces to contact the driving wheels with the road». Transformation of one equation to other (as their author demonstrates in article [6]) can not be the proof, that a new equation of wheel machine motion is absolutely correct. It is because that both of these equations are created with use of a disputable method of forces of leaders.

In attempt to justify use hypothesis of transfer to driving wheels of action for the body moments from resistance forces, the author of the new equation addresses the fact that "... Automobile is a mechanical system with the different nature of separate elements connections and difficult laws of their relative movements. It is possible to ignore some relative movements of elements while different tasks decision " [6]. Due to this G I Mamiti makes the conclusion that the car can be considered as a rigid body for the analysis of the car dynamic traffic.

It is very difficult to believe, that the words belong to a doctor of technical science. After all it is impossible to use a rigid model of automobile for all cases. For example, it may be used for analysis of extra braking regime with blocking driving wheels. When automobile moves and wheels with transmission elements rotate, the monolithic rigid body model does not correspond to reality, so the conclusions about its behavior with the point of view of the dynamic movement will be wrong. It is impossible to use such model for consideration of characteristics of productivity of the engine, characteristics of creation of gear and gear ratios, inertia of moments of rotation of parts and others.

For the analysis of a situation, G I Mamiti refers to a similar example when a sail on the boat get down in case of wind strengthening [6]. It reduces the force of the wind, and it happens, first of all, because of reducing sail area, but not because of reducing the height of an action point equal to force of longitudinal air resistance. For example, multi-storey sails aren't got down on big sailboats. They are attached to a cross-piece mast. It means that the center of a sail rises, but the surface of contact with an air reduces. The main goal of this process is to reduce overturn of a boat. When we estimate an influencing factor of height of an action point equal to force of air, we mean air resistance to the movement of the car. The opponents of the new equation understand a way of creation of this moment and don't deny its existence, unlike G I Mamiti's statements. In relation to the car, at the time of a body moves to the longitudinal direction, vertical reactions of the road in front and behind changes, but it

doesn't transfer to driving wheels. Driving wheels receive only a longitudinal part of force of longitudinal air resistance as counteraction.

Mamiti's attempts to adduce arguments in his favor as a constant on "publishing misfortune" -misprint aren't really convincing. In all conditions coefficients of this kind as $(h - r) / r$ leading to revolutionary conclusions in the theory of the car about a possibility of neutralization of resistance forces in initial version of a statement about novelty of the equation of the movement which appeared consistently in Russia in the third different technical journals [2, 3, 4] can't just be typos. It means a gross blunder of the author, but he hasn't recognized this mistake yet.

It is also necessary to note that the longitudinal forces applied to a car body during attempt to start the car "hands" because of the discharged accumulator aren't transferred via the spherical hinge as it is dictated by G I Mamiti [6]. These forces transfer to axes of wheels from the parts of the suspender and bearings fixed on them connected to a body. So the corresponding longitudinal reactions of resistance to the movement in contacts of driving wheels with the road which in result (together with effort of pressing a wheel axle) create on them turning points are formatted, given by means of the spherical hinge and axial shaft to transmission and further – on the crankshaft. If this moment is rather vigorous to turn a cranked shaft engine can be started, it is necessary to switch off coupling only in time and to press the brake pedal because the car can collide someone or something ahead of it.

If the hypothesis of G I Mamiti of transfer of action for the body moments on driving wheels is right, then their turn in the considered situation will depend on height of application of the pushing force to a body: the point of application, the transfer and the moment of the crankshaft more twisting is higher, the engine start is easier. But there is no such dependence, nobody noted it in operational practice, nobody advised in attempt to start the car "hands" to concern by force of pushing of the people to the highest point of the car. Special experiments confirmed that unlike application of longitudinal force to a body, application of the longitudinal moment leads to the movement of the car [1]. So the address to opponents "to go down on the earth" for start of their automobile engine in case of the discharged accumulator confirms, but destroys an initial hypothesis of the author of the new equation of the movement of the wheel car.

Everything told in this article explains the fact that four doctors and three Candidates of Technical Sciences from leading universities of Russia and Ukraine carried out the tough critical analysis of the new equation [1, 7, 8]. In the central technical publications there are no articles in support of its new theory of the movement of wheel cars. Therefore, it is time to complete this discussion which lasts more than a year.

List of reference literature

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