American Journal of Technology and Applied Sciences
ISSN (E): 2832-1766| Volume 12, | May, 2023

THEORETICAL ANALYSIS OF THE CAR BRAKING PROCESS

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A B S T R A C T

The friction systems shown in this work depend on the friction force and the gaps between the tire and the road decrease as the relative speed increases.

K E Y W O R D S

Braking, blocking, angular velocity, viscosity coefficient

Introduction

In most cases, traffic accidents are accompanied by the braking process of the car, so it is obvious that it is very important to study this issue and improve accident expertise. The study of the car braking process is based on the determination of its deceleration depending on the coefficient of friction, which relies on the simplest physical laws [1,2,3,4].

Despite many studies on this issue, there are opportunities at the current stage of gathering knowledge on this issue and increasing the efficiency of road transport. In particular, there are methods for determining the adhesion coefficient of a car wheel tire based on experiments, features of improving the surface and its model, and calculations based on modern advances in science and technology. When braking a car, it is necessary to determine the adhesion coefficient of the tire. For example, first, the speed of this car is calculated and the amount of its deceleration is measured [5,6].

The Main Part

The process of braking the car is the main one in the study. Determining its deceleration depending on the coefficient of friction is carried out using the simplest physical laws. Brake elements are vehicles related to the development of the automotive industry. In addition, frictional force depends on two parameters: reaction force support and friction coefficient. That is, processes related to friction are calculated using the coefficient of friction [7,8,9,10,11].

A special vehicle is reduced to determine braking and speed and stopping distance, which is studied using a minimization process. This is based on the complexity of the braking process. The integrated approach is that the braking process itself is a complex process. When studying the braking process, it is necessary to determine the movement parameters in the car, as well as take into account the process of the braking process itself (braking distance, deceleration, deceleration time). moving in a straight line, it is locked at the same time, then for the first few minutes it moves in a straight line, but soon the movement is very noticeable. External forces, for example, the component of gravity on a horizontal path increase the slope. This means that the car will slowly roll to the side and if it doesn't stop, it will go off the road [12,13,14].

If the rear wheels are moving in a straight line when locked, then the force associated with the release of kinetic energy acts on the car and its centre of gravity, helping it to move in a straight line. will give. But a vertical axis passing through the centre of gravity of some external forces tending to turn the car will not affect it. Even a small moment, for example, due to unequal braking forces on the right and left sides or the transverse cause, increases the angular velocity of the vehicle around the centre of rotation of the slope. If the connection between the tires and the road is to compensate for the torque, the rear of the car will have less force and move at a sufficiently high speed [15,16,17,18].

When locking the front wheels only, the front part of the car moves in a straight line, because this movement is determined by the position of the rotating rear wheels. However, if the vehicle has a slight overhang, it will be more likely to roll to the side than to lock all four wheels [19,20].

If the wheels on one side of a braked vehicle are on a less smooth surface than the other two wheels, the vehicle will roll in the direction of the high grip area. This phenomenon often occurs at the border between the main lane and the rest.

Exceptions can be imagined with a sufficiently high-speed vehicle decelerating at the boundary between the icy road and the road, and the coefficient of adhesion is acceptable, repeatedly and alternately. The wheels turn on the icy surface to one side, then to the other, then to the left, then to the right.

The study of the braking process, as mentioned earlier, is a comprehensive study. One of the factors that should be taken into account in the research is that the vertical vibrations of the passenger car part are isolated from the rest of the mechanical system motion within the light vibration theory. It is characterized by the following variables

$$X = X_1 + 4mM^{(-1)}\mathbf{E} \tag{1}$$

For example, if we consider the following condition, the kinetic energy generated in the formula will have a canonical form. In this case, the centre of mass of the car body at rest (C_0) lies in the middle of the segment connecting the centres of the wheels. The total pulses received are defined by

$$p_1 = \frac{\delta L_0}{\delta X} = M_0 X \tag{2}$$

$$p_\varphi = \frac{\delta L_0}{\delta \varphi} = M_0 b^2 \varphi \tag{3}$$

When we use the Hamiltonian function we wrote below, it takes the form:
$I_1 \psi_1 I_2 \psi_2$ according to the following equations:

$$P_e = \sqrt{2mI\omega}\cos\psi \qquad \omega = \frac{4c}{m} \tag{4}$$

$$P_e = \sqrt{2mI\omega}\cos\psi_2 \qquad E = \sqrt{\frac{I\omega}{2c}}\sin\psi_2 \quad \omega = \frac{4c}{m} \tag{5}$$

And represents the possible values when the total energy changes and new variables of our mechanical system (Hamiltonian). To do this, use the expression (2) for the work of possible forces. It is necessary to determine the generalized forces for displacements and ratios, and after determining the generalized forces, we use them in the canonical Hamiltonian equations (4), which we express in the following form:

$$i_k = \frac{\delta H}{\delta \psi_k} + Q_{\psi_k} = Q_{\psi_k} \quad (6)$$

Assuming that the frequencies of undisturbed oscillations are independent, we use the averaging method to analyze the behaviour of the solutions to the system of equations. The change in the movement of a light car is characterized by the average equations for its states, and variable movements, in this case, keeping the signs of the variables, we express the average equations in the following form:i_k

$$i_k = \langle Q_{\psi_k} \rangle m, \qquad k = 1.2 \quad (7)$$

We assume the condition of undisturbed movement of the mechanical system (in our case, the machine) is represented by the uniform movement of the centre of mass of the system and undamped harmonic oscillations along the variable frequency will be one. If the condition is fulfilled (F=N=0) movement will happen.

For averaging using "fast variables", we get the following system of equations. Based on the theorem of change of mechanical energy, we express the movement in the following form:

$$\frac{dv}{dt}(T + P \sim) = kMgv^2(l - gv^2) - 4Nl^2\varphi^2 \quad (8)$$

On the basis of the obtained laws, it can be seen that the system of differential equations (8) can describe the transient process during which spontaneous oscillations can occur, the process of car braking, and inequality (8) represents the dissipative. Non-linear friction characteristics during braking are considered.

Conclusion

The friction systems shown in this work depend on the friction force, and the clearances decrease as the relative speed between the tire and the road increases. However, this speed will need to be modelled and determined on a fixed basis. When studying the braking process using an integrated approach, spontaneous vibrations appear, which are formed when the wheels are locked.

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