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Improvement of the Assessment Methods for the Braking Dynamics with ABS Malfunction

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Abstract

The bulk of automobiles are equipped with ABS currently. Having of automatic devices that prevent vehicle wheels from locking and skidding does not require consideration of the normal reactions on the front and rear vehicle axles wheels' changes dynamics. However, ABS malfunction is possible for various reasons, and in this case the braking system must provide the safety vehicle braking. To provide this, it is necessary to return to the problem of choosing the rational braking forces distribution between the wheels of the front and rear axles.

Analysis of known methods for determining the rational choice of the braking forces distribution between the axes made it possible to reveal a number of inaccuracies and contradictions, to which the following notes can be attributed:

- traditionally it is determined the limiting forces distribution on the wheels' adhesion with the road in case of emergency braking, and according to its braking moments distribution, which does not take into account the influence of inertial masses, which are applied to the wheels;
- when the normal reactions on wheels and their redistribution between the axles are determining, the changing in the point of application of the braking force, during the wheels' locking, is not taking into account (when the wheels are unblocked, the braking force is applied to the wheel axle, and when the wheels are locked, the braking force is applied to the contact spot of the wheels with the road).

The article deals with analytical expressions which allow to make a rational choice of the brake moments distribution between the front and rear wheels, taking into account the inertial masses of a powertrain.

It is shown that the known law of the ideal distribution of tangential reactions between the axes corresponds to the automobile braking with all blocked wheels. If it is necessary to bring simultaneously the front and rear wheels to the blocking limit, then it will be necessary to choose another law of braking forces distribution between the axles, at which the front brakes are weakened and the rear brakes are strengthened. Simultaneous bringing to the blocking limit the front and rear wheels does not prevent locking of the rear wheels first.

It is determined that in case of the ABS failure on the rear wheels and the normal work of the ABS on the front wheels, makes it possible to improve the stability of the automobile (compared to the ABS failure on the all wheels) by increasing the normal load on the rear wheels.

The recommendations, which are given, can be useful at the development of automobile braking systems. They will allow increasing safety of automobile braking not only at ABS malfunction, but also at service braking when ABS is not working.

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Topic

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