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# «Metrological Support of Innovative Technologies» ICMSIT-II 2021

«Analysis of model for assessing the road train movement stability»

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# Problem statement

- Road trains (RT) remain the main mode to transport freight. Therefore, improving the performance of RT and reducing accidents on the road is a highly topical issue, which is also of great practical importance.
- A method of ensuring the stability of RT movement by upgrading the design of towing couplers has been previously proposed, and the relevance and practical significance of this method has been confirmed by a number of patents. However, the critical values of the relevant parameters of RTs, resulting in the loss of its directional stability, have not been established, which does not allow for optimization of the technical and operational characteristics of the motor vehicles to the most effective degree.
- The purpose of this work is to establish the critical characteristic parameters of RT resulting in the loss of its directional stability on the road if there are external actions.



# Solution methods

- This paper presents the analysis of previously proposed mathematical dependencies in order to identify the boundary conditions and actions that are most typical to ensure the RT movement stability on the road, as well as to determine the critical modes and characteristics of RT yawing process.
- The research methods are mathematical analysis, mathematical simulation and prediction of RT behaviour on the road.
- In our opinion, the most dangerous (in terms of ensuring the stability of RT movement on the road) areas of external action application are those elements of RT mechanism which have more degrees of freedom of their movement. Such elements are the following: for double-axle trailer – the line of trailer front axle (in its interception with the longitudinal axis of the trailer, there is a *PP* centre of the trailer located); for single-axle trailer – the point where the trailer drawbar is attached to the trailer hitch (towing device).



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# Conclusions

## Results, implementation

- The limit value of external (destabilizing) momentum shall not exceed 0.5–1.0% of the RT trailer momentum value, otherwise it is impossible to ensure the trailer stability. The duration of the external perturbing action has a more significant effect on the value of sidewise skidding of the RT trailer than the magnitude of the external perturbing force. Increasing the RT momentum results in the increase in the permissible critical angles of displacement of its elements (increase in the RT stability).
- The established dependences of the drawbar rotation angle and the trailer lateral displacement on the values of momentum of the trailer and vehicle, lengths of the drawbar and trailer, magnitude and duration of impact can be used to improve both technical (dimensions of RT elements, such as drawbar length) and operating (rotation radius, critical speed, etc.) characteristics of road trains.

# Contacts

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