Numerical solution of the twin wheel gear's shimmy model based on poly-component dry friction

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ABSTRACT

A shimmy phenomenon is important problem with wheel vehicles (automobiles, bicycles et. c.). The well-known and widely used in engineering practice theories are based on different models of the tire-road contact interaction: physical, empirical and semi-empirical ones.

The empirical models as well as the semi-empirical ones are validated by the experimental data for many cases of rolling with both longitudinal and lateral sliding. It must be noted nevertheless that all the empirical models are based on the Coloumb theory of isotropic dry friction. The friction anisotropy or a dependence of the friction coefficients on the velocity are not considered. On the other hand several investigations have shown that the dry friction law differ significantly from the Coloumb law if the sliding is combined with the spinning if even the last one vanishes. This effect was found by and P. Contensou [1] and Th. Erissmann [2] formulated by these authors as a combined dry friction, or, generally, a dry friction with combined kinematics. The complete theory of the combined dry friction was developed by V.Ph.Zhuravlev [3] together with A.A.Kireenkov [4].

The applicability of the multi-component dry friction theory [5] for the investigation of the rolling's stability was shown by V. Ph. Zhuravlev together with D. M. Klimov [6].

In this work, a numerical solution of the shimmy dry friction model for twin wheels was provided. The stability limits was found. Parameters influence on the stability of motion was obtained.

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