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DYNAMIC STUDY OF RAILWAY VEHICLES CONSIDERING A VARIABLE COEFFICIENT OF FRICTION IN THE WHEEL-RAIL INTERFACE

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ABSTRACT

The continuous improvement of the railway field constitutes a major contribution for the existence of a more sustainable and environmentally friendly transportation network. Thus, the development of reliable computational multibody models to reproduce the dynamic behavior of vehicles, tracks and their mutual interaction is key to design suspension, traction and braking systems, prevent derailments, perform virtual homologation, or even to use the virtual twin of the system to perform condition monitoring of both the vehicle and the track and schedule maintenance operations. Moreover, the wheel-rail contact plays a role in those models, since the contact forces are responsible for supporting and guiding the vehicle, as well as promoting traction and braking actions. The accurate modeling of the wheel-rail contact is also important to consider several tribological phenomena that damage the surfaces, as the wear, plastic deformation or rolling contact fatigue. A significant part of the rolling stock and railway infrastructure maintenance costs is related to these damage phenomena, namely the inspection operations, track downtime, reprofiling and replacement of parts. In particular, the surface wear is highly linked with the magnitude of existing creepages and creep forces, which are dependent on the friction level between wheel and rail. Although the coefficient of friction is usually taken as constant value for railway dynamics analyses, due to the introduction of local lubrication or friction modifiers on the wheel flange and/or rail gauge, or even due to the presence of contaminating substances, friction can vary along the contacting surfaces. This work aims to study the influence of considering a variable friction coefficient along the wheel profile on the dynamic response of a railway vehicle and wear index calculation. For this purpose, a vehicle negotiating a curved track under different operating conditions is used to verify the results of the application of the developed methodology.

Keywords: *railway dynamics; wheel-rail contact; friction coefficient; wear*

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