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SIMULATION AND EXPERIMENTAL INVESTIGATION OF TIRE TREAD BLOCK WEAR IN THREE-BODY CONTACT

Duc Nam Nguyen[1] and Stephanie Kahms[2]

[1] Leibniz University Hannover, Institute of Dynamics and Vibration Research, An der Universität 1, 30823 Garbsen, nguyen.duc@ids.uni-hannover.de, www.ids.uni-hannover.

[2] Leibniz University Hannover, Institute of Dynamics and Vibration Research, An der Universität 1, 30823 Garbsen, kahms@ids.uni-hannover.de, www.ids.uni-hannover.de

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On gravel roads, the tires are not in direct contact with the surface. Particles of e.g. sand or stone form an intermediate layer between the tire and the road surface. The particles either are embedded in the tire surfaces or are free to roll and slide [1]. Moving particles cause the tire to wear [2]. The abrasive wear process on three-body abrasion depends on many parameters as contact pressure, velocity, material, abrasive particle properties, and surface roughness. The influence of these factors contributes to complex contact conditions resulting in different wear mechanisms of the tires.

In general, experimental and numerical methods are chosen to predict the wear rate of tires. An experimental approach is often proposed to investigate the wear behavior, such as the determination of mass loss, wear rate, and examination of the worn surface. The experimental method is efficient and often useful because all physical effects and their interactions are combined. However, experiments are expensive, time-consuming, and are only valid for the used test configurations. Numerical simulations are used to investigate the relevant factors of abrasion. The simulation results also provide further information during the wear process, such as changes in the worn surface and pressure, in order to better understand the wear behavior [3].

The presentation focuses on the mechanical modeling and abrasive wear simulation of the tire tread sample in three-body contact (tire tread sample, particles, and road). The model is constructed two-dimensionally (2D) for consideration of the high demand for computing power. The finite element method is chosen to describe the dynamical behavior of the tire tread sample. The model can simulate the tire tread sample's time-dependent wear depth, wear rate, and local contact pressure. The influence of parameters, such as surface roughness, contact pressure, velocity, sliding distance, and material properties on the wear behavior, is considered in the simulation. The results of the wear simulation are compared to the experimental results. Similarities and differences between the simulation and experimental wear results are analyzed and compared to indicate the model's usefulness and limitations.

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