

SLIDING WEAR PREDICTION IN WHEEL-RAIL SYSTEM UNDER AQUEOUS CONDITION

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KEYWORDS

Wear; experiments in tribology; modelling in tribology; computer simulation.

INTRODUCTION AND METHODOLOGY

Sliding wear poses a significant challenge across various sectors, such as in the railway industry, particularly at the wheel flange and rail gauge corner contact. Laboratory pin-on-disc tests are commonly used to study sliding wear, but they are constrained by high time and cost [1]. Therefore, this study assessed the speed and applicability of the semi-analytical computational method GIWM (Global Incremental Wear Model) [2] in identifying the dimensional wear coefficient ($\text{mm}^3/\text{N.m}$) and predicting wear rates (mm^3/m) in railway steels, using tribological tests with water addition to simulate rainy-day railway operations. The algorithm was adjusted to include calibration parameters (Root Mean Squared Error) and wear rate calculation following ASTM G99-17 standards, as shown in Figure 1. Other equations follow the original work. Experimental data [3] were used for model calibration (5 N normal load) and predictive analysis (10 N normal load).

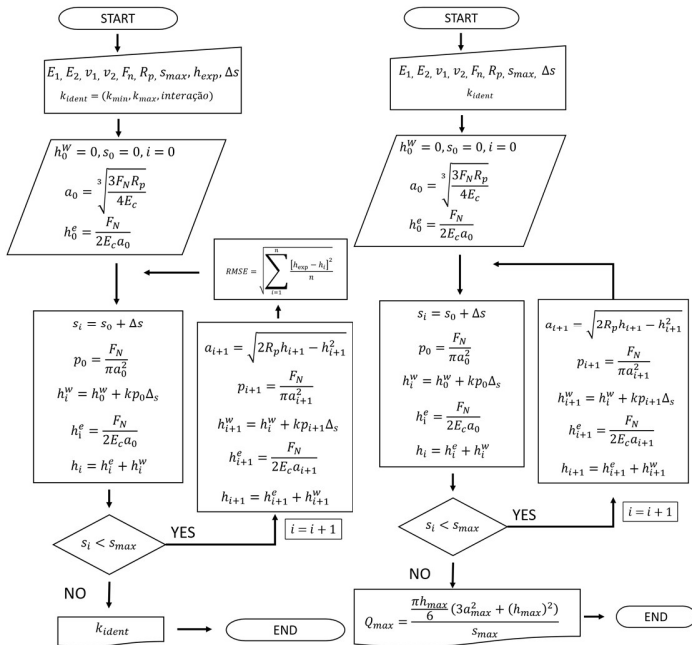


Fig. 1: Flowchart for (a) calibration and (b) prediction of the GIWM algorithm with pin-on-disc experiment.

RESULTS AND CONCLUSIONS

Although the GIWM method provided a swift analysis compared to experiments, it exhibited limited agreement under specific test configurations, resulting in a 28% discrepancy in the final wear rate compared to tests conducted under a 10 N load, as illustrated in Figure 2. Such divergence is attributed to the absence of water modeling in the algorithm. Therefore, it is concluded that, while the GIWM method is computationally efficient, further refinement is required to incorporate aqueous conditions.

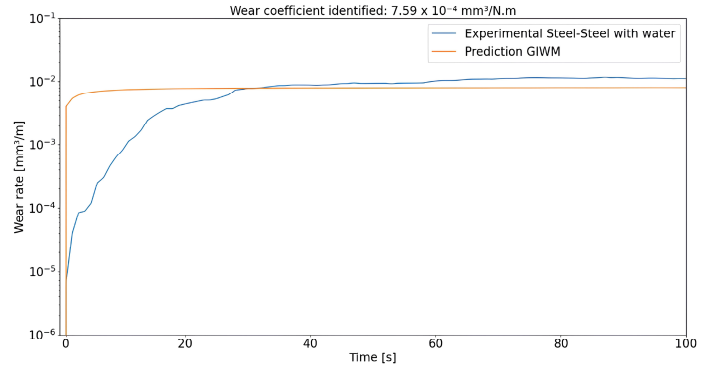


Fig. 2: Comparison of GIWM prediction with pin-on-disc experiment.

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