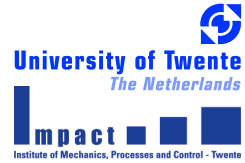# Slippery Tracks: Wheel - Rail Contact

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Introduction

Low friction due to a bio-film between wheel and rail is generating a security issue in which the braking manoeuvre is failing. Solving this is the biggest priority in railroad industry.

Objective

The objective of this research is to find a solution to remove the interfacial layer which causes the low friction between wheel and rail. A first step in the process is to predict the coefficient of friction as a function of velocity (Stribeck curve) and as a function of slip or slide to roll ratio (Traction curve) assuming that the interfacial layer behaviour is non-linear viscous.

Model

A fully deterministic microcontact and friction model was developed for the elliptical contact situation. The present friction model is based on the line contact model developed by Gelinck [1] and the hydrodynamic lubrication model.

Inputs

In order to get as close as possible to reality, rail and wheel samples were used for a first set of measurements (Figure 1):
- Surface roughness (Interferometer, IM);
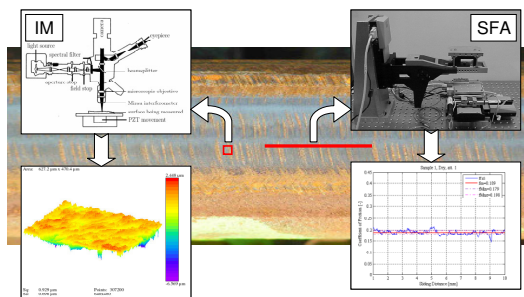- Coefficient of friction in BL regime (Surface Force Apparatus, SFA).

Figure 1: Measurements of the rail samples.

Outputs

The main output of the model is the Stribeck curve which describes the variation of the coefficient of friction as a function of velocity. Stribeck curves for 3 types of interfacial layers (water, oil and grease) are presented in Figure 2.
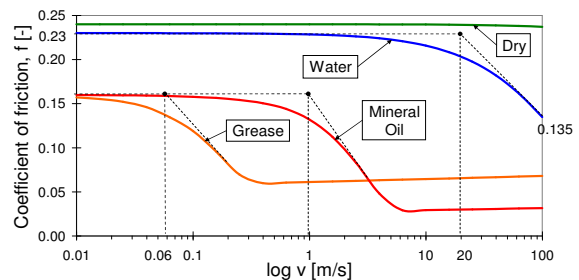

Figure 2: Stribeck curve for wheel - rail contact.

Second result of the model is represented by the evolution of the coefficient of friction with increasing the slip or slide to roll ratio.
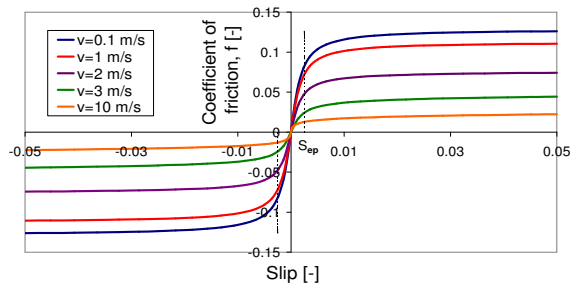

Figure 3: Traction curve for wheel - rail contact.

Based on these findings the effect of the interfacial layer on the friction level in these contacts is shown to be significant.

Future work

Introducing the side slip component into the model and viscoelastic behaviour of the interfacial layer.

References

[1] Gelinck, E.R.M. and Schipper, D.J. (2000), "Calculation of Stribeck Curves for line contacts", Tribology International, 33, 175-181.