KTH Railway Group

Centre for Research and Education in Railway Technology

SWEDTRAIN, 2016-11-14

Wheel damage prediction activities

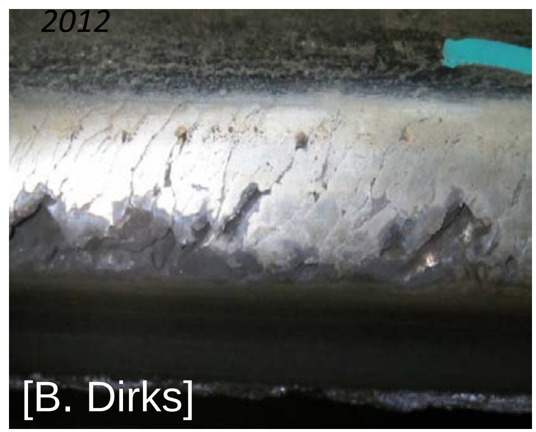
Wear and Rolling Contact Fatigue (RCF)

- Wear

New *Worn*

- RCF

Älvsjö – Västerhaninge, Feb. 2012



X2000, Stockholm-Göteborg, Feb. 2008

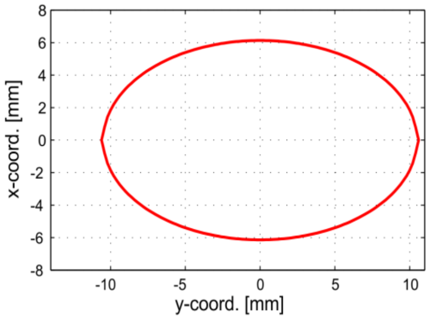
First step to predict them

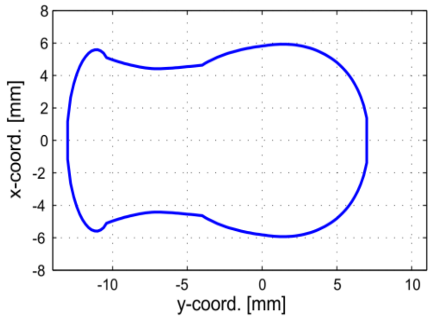
- accurate contact modelling

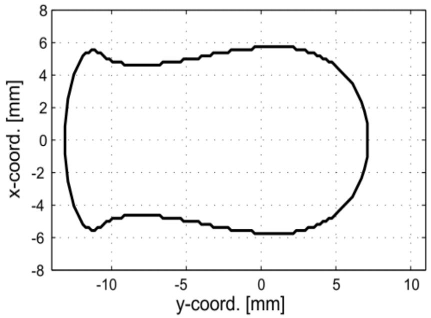
Modelling Wheel-rail contact

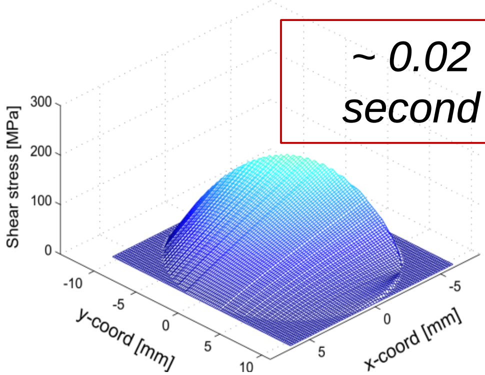
Fast ⟷ Accurate

Hertz+FASTSIM	ANALYN+FaStrip	CONTACT code

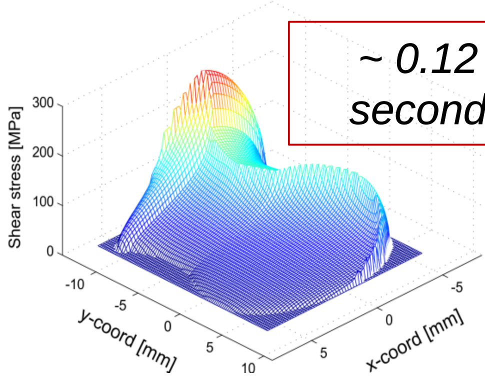




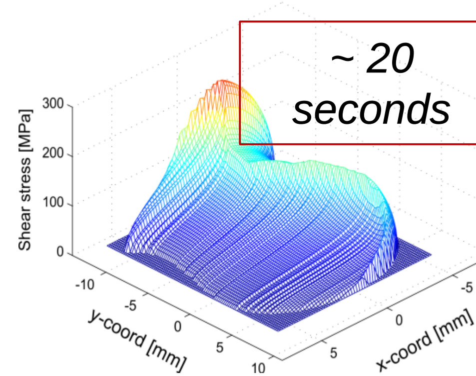




~ 0.02 second



~ 0.12 second

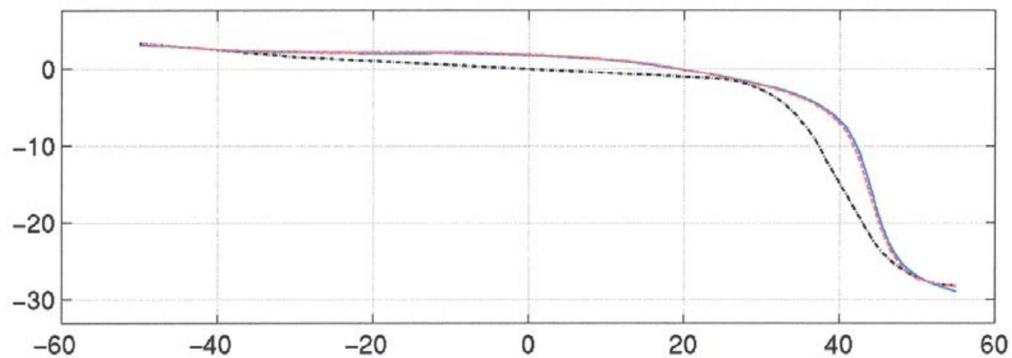


~ 20 seconds

Wear and fatigue of wheels and rails

Example of measured and calculated wheel wear.

Stockholm commuter vehicle X10, 200000 km of running distance.

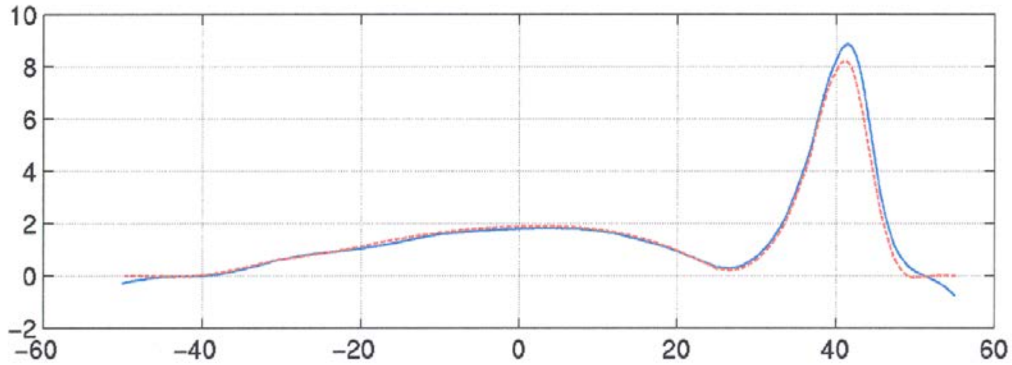


Wheel profiles:

Initial

Measured

Calculated



Radius decrease:

Measured

Calculated

Wheel wear prediction for high-speed trains

Yuyi Li, PhD student

A typical mileage of such a train is 1 million km per year.

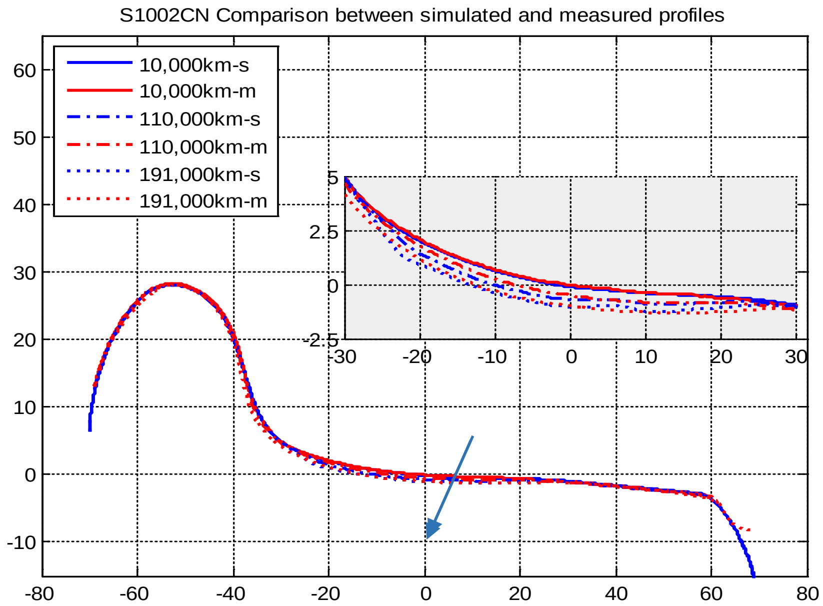
The aim is to predict wheel wear to choose the 'best' wheel profile for the high-speed train

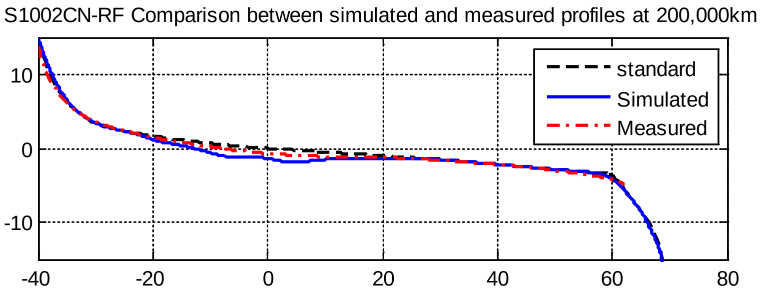
Final aim:

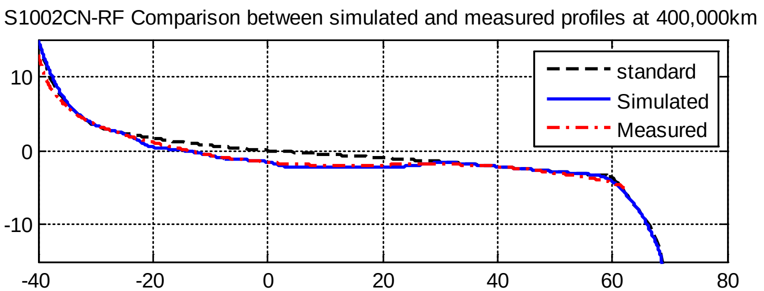
→ reduce maintenance cost

Prediction and validation

Validation of S1002CN and S1002CN-RF



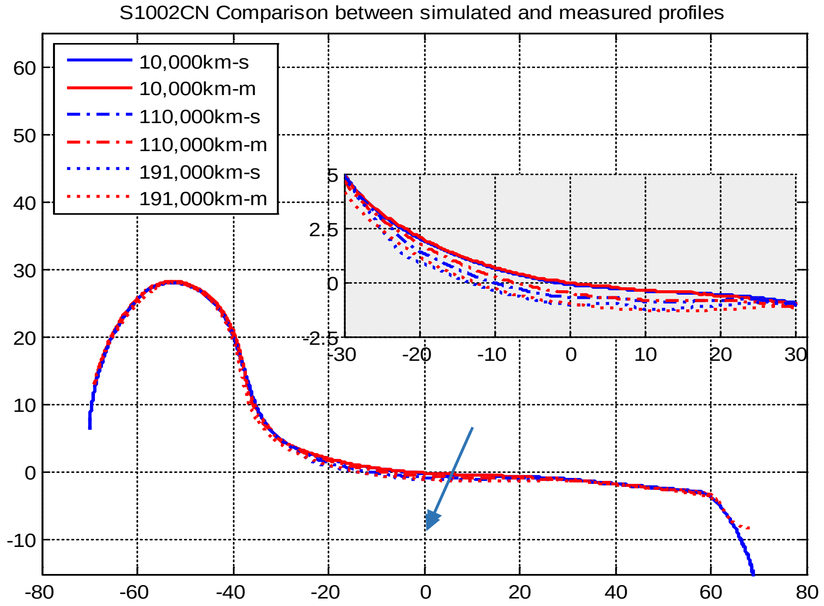


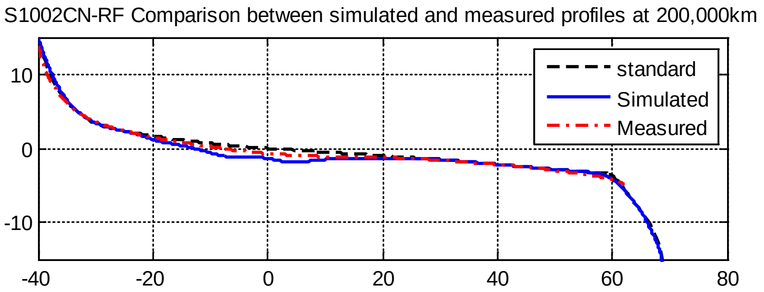


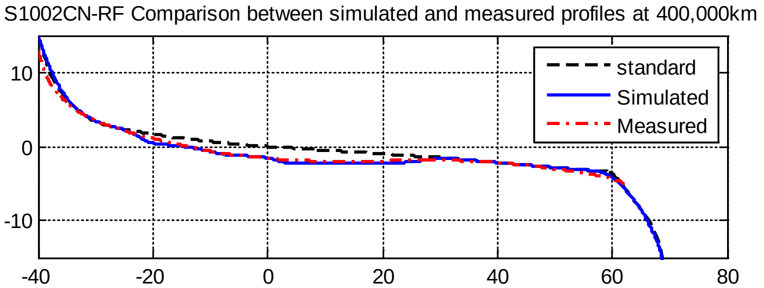
- For S1002CN, compared with measured data at 10,000 km, 110,000 km and 191,000 km, the simulated wheel profiles coincide well.

Prediction and validation

Validation of S1002CN and S1002CN-RF







- For S1002CN-RF, the simulated radial wear rate is larger than that of measured profiles before 200,000 km, however on the contrary during 200,000 km to 400,000 km

An Investigation of Iron-Ore Locomotive

Wheel Damages

using Vehicle Dynamics Simulation

Saeed Hossein Nia

Prof. Sebastian Stichel, Dr. Per-Anders Jönsson, Dr. Carlos Casanueva

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Background

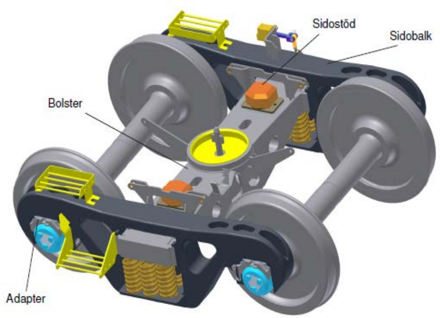
ED **braking** Tread **brakes**

68

. . .

745.53 m

Amsted **Three-Piece Bogie** with load sensitive friction damping



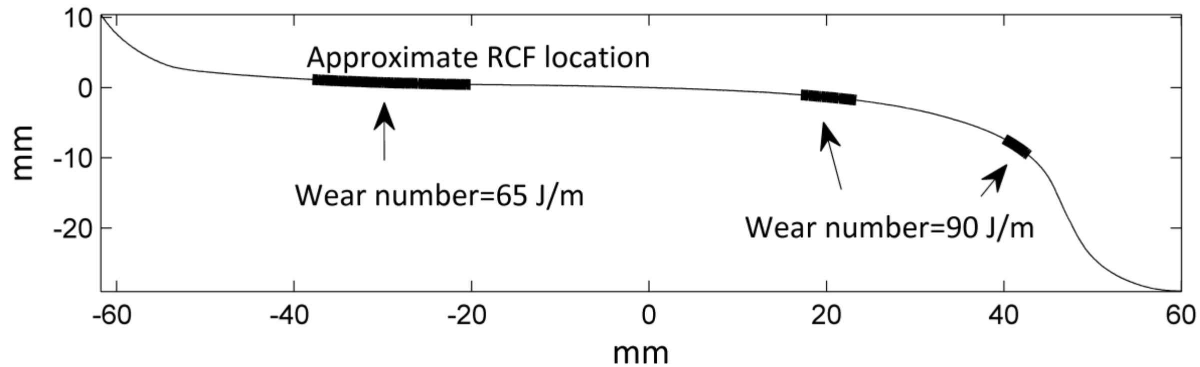
Axle load: 30tons

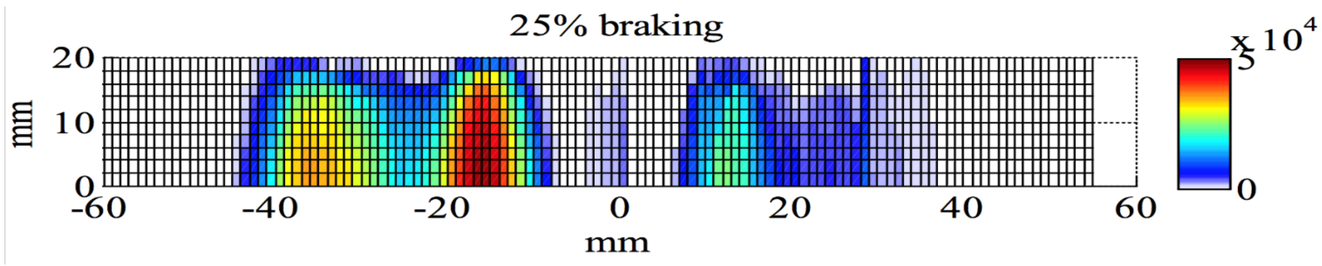
Mass of the loaded train: 8’400 tons

Max. **speed** on tangent track: 60km/h(Laden)-70km/h (Un-laden)

Prediction of Rolling Contact Fatigue

Wheel of LKAB iron ore locomotive.
RCF severity after 40000 km



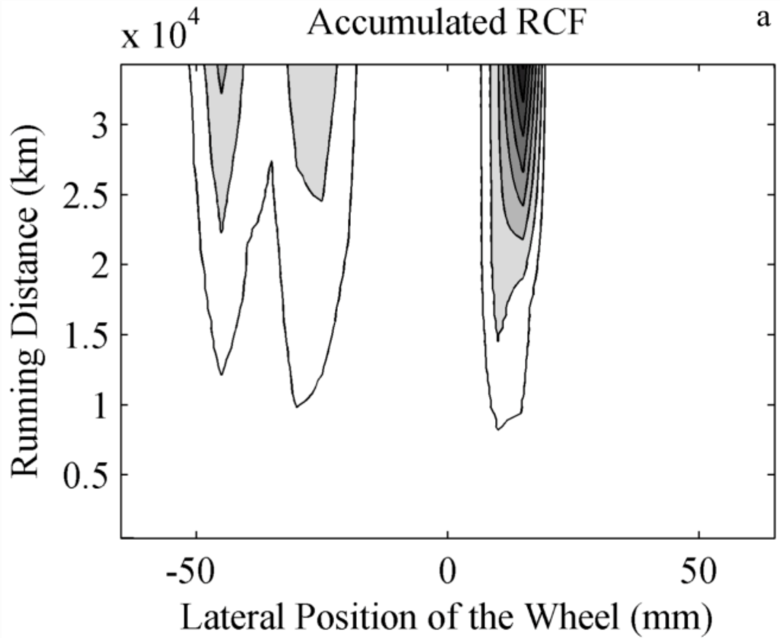


Coincides very well with experience: Reprofiling due to RCF needed after 40000 km running distance

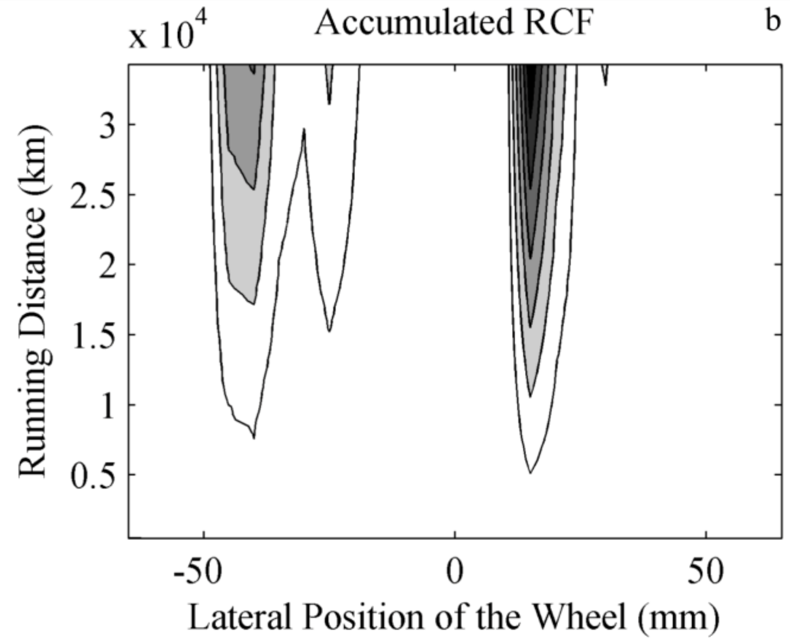
Prediction of Rolling Contact Fatigue - Wheel profile optimisation

Calculated Rolling contact fatigue for different profiles.
Wheel of LKAB iron ore locomotive.

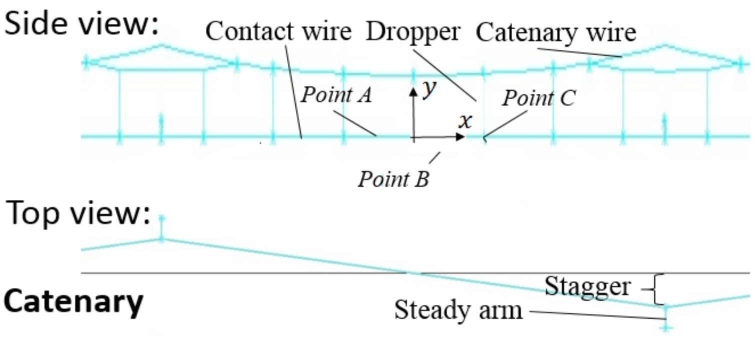
Profile WPLX2

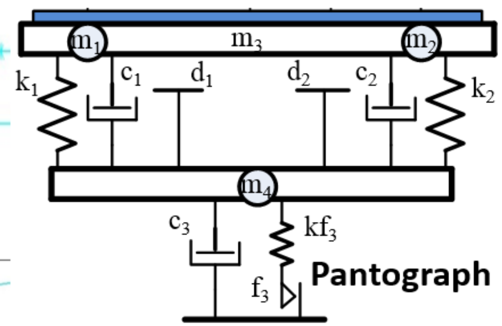


Profile WPLX4



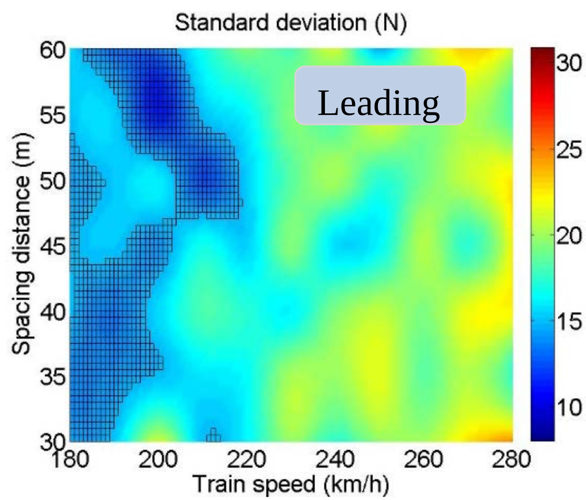
Dynamic pantograph catenary interaction----
Optimization with computer simulation

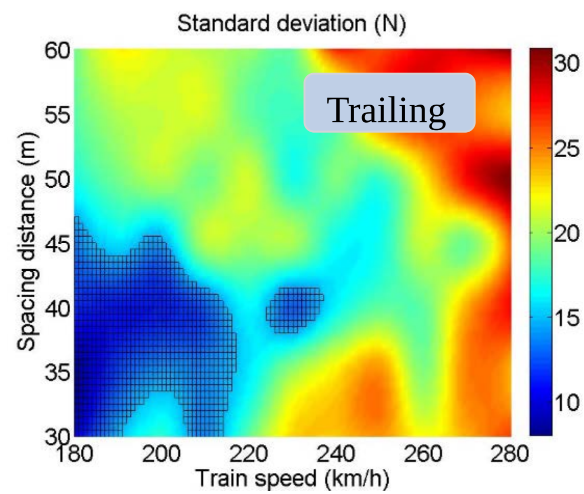




To improve dynamic performance and increase operational speed

Especially for the Swedish soft catenary system





One pantograph is taken as ***auxiliary pantograph*** for the other pantograph.

Joint Master in Railway Engineering

From 2017 we will hopefully have a Joint MasterPprogram together with RailTec at the University of Illinois Urbana-Champaign