Contract No. 777564

INNOVATIVE RUNNING GEAR SOLUTIONS FOR NEW DEPENDABLE, SUSTAINABLE, INTELLIGENT AND COMFORTABLE RAIL VEHICLES

D1.3 – Description and assessment of methods for condition monitoring

Leader/Responsible of this Deliverable: Stefano Bruni POLIMI

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Dissemination Level		
PU	Public	
CO	Confidential, restricted under conditions set out in Model Grant Agreement	X
CI	Classified, information as referred to in Commission Decision 2001/844/EC	

Start date of project: 01/09/2017 Duration: 25 months

PUBLISHABLE SUMMARY

The objective of Run2Rail WP1 is the formulation of technology concepts for condition monitoring systems to be applied in the next generation of railway running gear. The work is aimed at defining technology concepts for the following three case studies:

- Wheelsets;
- Bearings and gearboxes;
- Suspension components.

This report focuses on the definition of data processing and fault detection methods to process on-board measurements in view of monitoring the health state of various vehicle components. The activities performed and the results obtained are:

i) Monitoring of in-service fatigue stress cycles in view of extending the periodicity of non-destructive inspection of the axle and to optimize axle inspection according to the actual mission profile of the vehicle, with potential large savings on maintenance costs of the axles.
ii) Processing of signals from sensors embedded in the wheelset axle to monitor the occurrence of wheel flats and/or wheel polygonization, with the final aim of optimizing the wheel tread reprofiling periodicity.
iii) Monitoring of wheel/rail contact forces using a simple and low-cost strain-gauge-based Wheel/wheelset In-Service Force Monitoring (WISE-FM) system. This system could complement the one envisaged at point i), providing additional benefits in terms of detecting anomalies in the running condition of the vehicle, improving running safety, providing feedback signals for active suspensions.
iv) Monitoring of faults in gearboxes and bearings to diagnose the health of the complete gear chain/bearings/motor unit. A signal analysis toolbox was created, which enables the processing of the measured signals to elaborate several different condition indicators and implements Machine Learning (ML) algorithms for fault detection and classification. The toolbox was tested on measurements from databases available in the literature and also on measurements from a run to fail test performed as part of activities in this task.
v) Monitoring of primary suspension components, to diagnose the condition of primary suspension components. Three different methods for fault detection and fault classification, having different requirements in terms of number of sensors, were defined and assessed by means of numerical experiments performed using a Multi-Body Systems (MBS) model of a railway vehicle.

The data processing methods described in this report are directly linked to the definition of sensors and other hardware provided in Deliverable D1.2 for the three case studies mentioned above, around which WP1 is structured. For each one of these case studies, the combination of the hardware selection achieved in Task 1.2 and the definition of data processing and fault detection methods provided by this deliverable form the three technology concepts representing a

final outcome of the WP, whilst the detailed assessment is being carried out in Task 1.4 and will be reported on in Deliverable D1.4.