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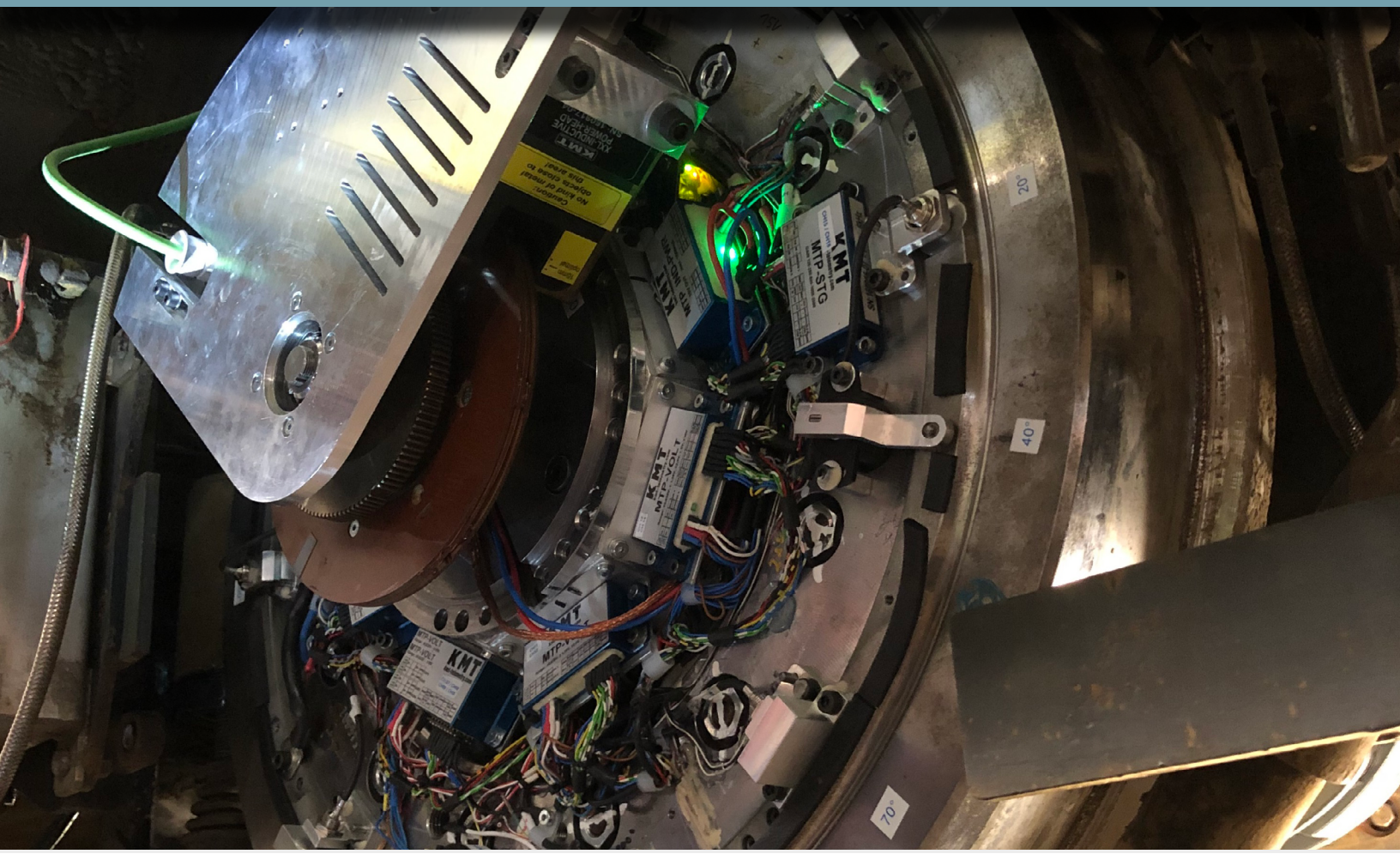

Collecting Dynamic Loads on Rail Vehicle Wheelsets

How imc telemetry supports simulation models

imc Test & Measurement
Application Note // By Peter Schreiweis, Rail Vehicle & NVH Expert, imc Test & Measurement

APPLICATION NOTE

Introduction

A rail vehicle is subject to various dynamic loads under real operating conditions. Determining these loads is a cornerstone of railroad vehicle development.

The project of the German Gutehoffnungshütte Radsatz GmbH (GHH-Radsatz, since 2014 GHH-Bonatrans), a company that is specialized in rail vehicle wheel set solutions, was about the development of models for dynamic load simulation on streetcar wheels. To this end, GHH-Radsatz developed a measurement wheel for use on a streetcar in order to acquire data on relevant parameters. This included a telemetry system from imc Test & Measurement.

FIGURE 1.
Streetcar in Dresden with measurement wheel

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Data Acquisition on Rotating Components

In March 2019 GHH-Radsatz equipped a tram of the Dresdner Verkehrsbetriebe (DVB) in Dresden, Germany, with a measurement wheel which acquired data during actual vehicle operation for the development of static and dynamic FE (finite element) and MBS (multibody) simulation models. These models were intended for use as early as the design phase to allow prediction of the dynamic behaviour of rubber sprung tram wheels or wheelsets.

The measurement wheel from GHH-Radsatz was built into the first leading wheelset of the measurement tram and included the imc MTP telemetry system - originally a product from imc's partner KMT - used for the data acquisition on the wheel and wireless data transfer.

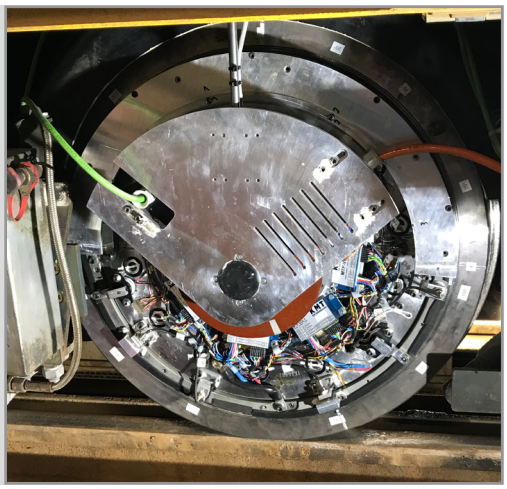

FIGURE 2.
The imc MTP telemetry system as part of the GHH measurement wheel

© GHH-Radsatz

The telemetry system consisted of several components, of which 16 sensor modules were integrated into the measurement wheel and the controller module outside of the wheel, for wireless data transfer. This setup is especially suited to rotating applications and components.

With the MTP telemetry, the controller receives the data from the measuring modules, generating a bit-serial data stream (PCM). Each measuring module has two analogue inputs and includes signal conditioning, anti-aliasing filter and 16bit A/D conversion. The data rate to the stationary decoder is 5000 kbit/s, whereby the measurement data as well as the electrical power are transmitted inductively without contact.

Data Acquisition On the Wheel

During operation of the tram in the city of Dresden, a wide range of data were acquired under real conditions. To create a precise and comprehensive database for the FE and MBS models, signals were acquired from a total of 16 sensors. These sensors measured the radial, axial and torsional displacement of the wheel rim relative to the wheel hub. Strain gauges captured the strain and deformation of the wheel rim during operation. Furthermore, temperature probes were installed on the wheelset rubber rings for temperature measurements.

Because the sensor modules were placed close to the sensor, undesirable environmental influences were kept to a minimum.

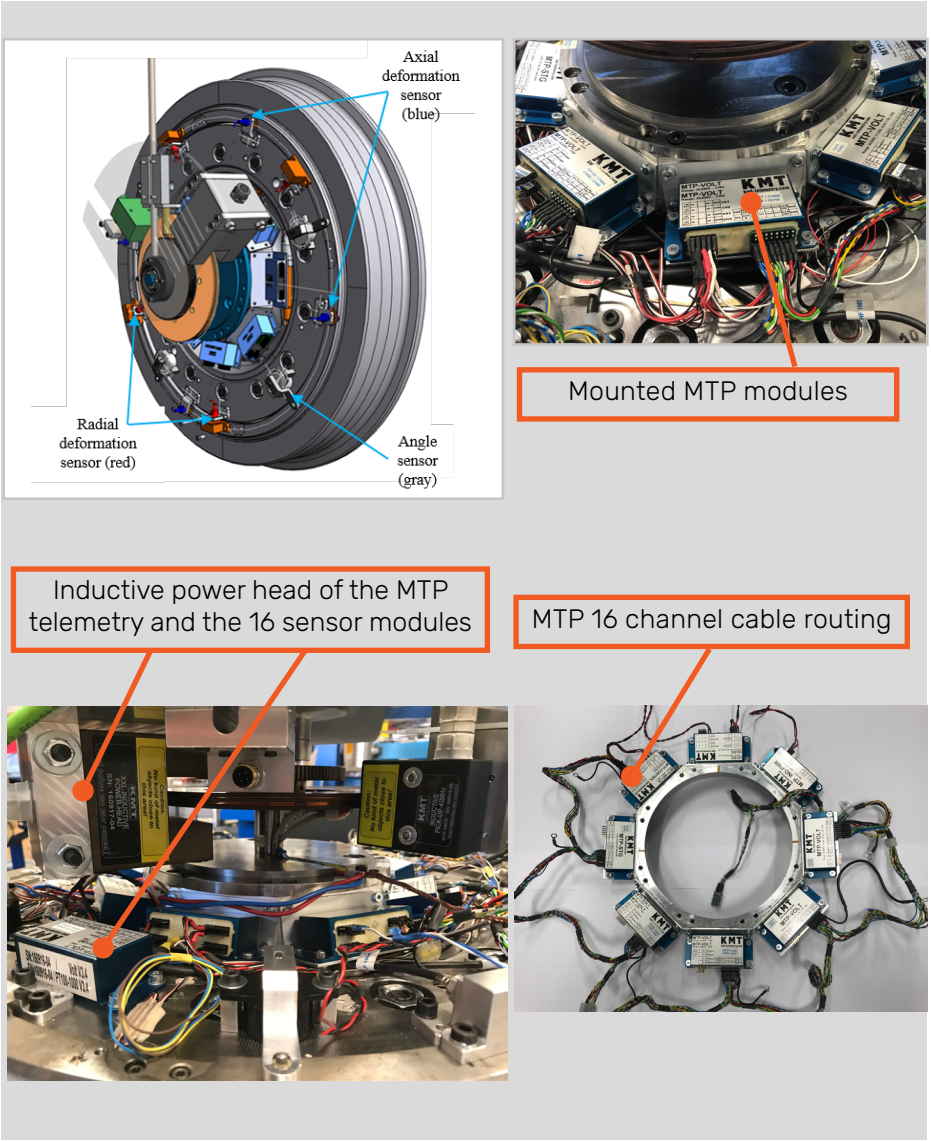

FIGURE 3.
The sensors and imc MTP telemetry system installation in detail

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Post-Processing Measurement Data

The evaluation of measurement data, regardless of its source, could have been executed with the data analysis software imc FAMOS. FAMOS offers useful tools that correspond to the demands of engineers and technicians, specially for comprehensive data sets like those acquired during road load data measurements, Visualization and analysis features and automatized measurement routines, ranging from data import to creating meaningful reports, help to generate and to communicate measurement results efficiently.

Conclusion

Thanks to the modular design of the MTP telemetry system, all important and characteristic parameters of the vehicle wheelset could be acquired with one system, allowing GHH to adapt the measurement wheel to the demands of data acquisition on a streetcar vehicle.