

Teamwork: Vehicle test and inspection systems

Siemens: Dynamic truck rear axle transmission test rig for SCANIA

As an automotive industry partner, Siemens A&D, in its vehicle test and inspection systems division provides innovative solutions for testing vehicles and vehicle components throughout the world. By using the latest HBM torque measurement technology new ground was also broken when designing a transmission test rig for SCANIA in Sweden.

A 4-machine test rig was installed at the SCANIA Technical Centre in Södertälje in Sweden to determine data about fatigue, service life and function of truck rear axle transmissions. It was used to develop rear axle transmissions, particularly for heavy goods vehicles with and without a tandem-axle. This is why a total of four electric machines are needed in the test room as drive and loading units.

With a fast control system (CATS_{TC}), robust test rig control and a flexible automation system (CATS_{NT}), the highly functional test rig is able to control a wide variety of different machine configurations (2, 3 or 4 machine operation) and accompanying control modes in the required dynamic response.

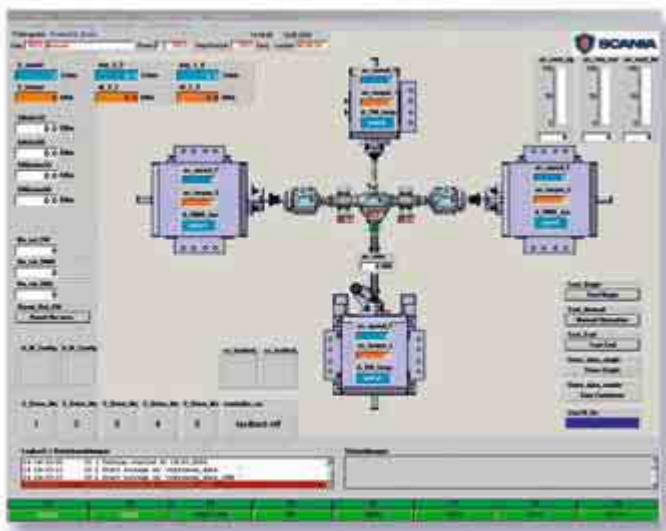


Fig. 1: CATS_{NT} automation system;
all the relevant test rig data at a glance

The drive concept

To ensure that the test rig was readily available, the chosen drive concept had the following advantages:

- No matching gears,
- No adjusting devices,
- High-precision torque measurement:
 - HBM T10FM torque flanges
 - HBM Z4A force transducers
 - HBM PME/MP60DP and MP30DP amplifiers
- Low connection power:
Despite the high power rating for the installed machines of 5,540 kW, it was possible to limit the AFE line-side converter to 2 x 800 kW. This also guarantees dynamic operation.

HBM measurement technology

Four HBM T10FM torque flanges for torques to a maximum of 40 kN-m are used to record the torques at the test specimen. The sensor data is conditioned by HBM's MP60DP amplifiers. These deliver the measurement data to the automation system digitally via an integrated ProfibusDP interface, without additional conversion.

... with HBM

from Siemens A & D ...



Other equipment features

- Control and monitoring:
SIMATIC S7-300 PLC and ET200 distributed I/O stations
- Control system:
Real-time processor system, MATLAB/SIMULINK control system software CATS_{TC} and manual operator control level
- Operator control/automation:
Industrial PC system with the CATS_{NT} automation system
- Measurement technology
To evaluate the sensor signals of the test rig and the test specimen: · HBM PME/MP60DP and MP30DP amplifiers, ET200M distributed I/O stations and PROFIBUS optical fiber cable connection to the CATS_{NT} control system and to the CATS_{NT} automation system



Fig. 2: Test rig with rear axle transmission as a test specimen

Machine specifications

- drive machine (cardan)
1,830 kW, 25 kN·m from 0 to 692 rpm
max. speed 2,320 rpm
- Two wheel machines, each:
1,415 kW, 40 kN·m from 0 to 333 rpm
max. speed 1,200 rpm
- Cardan machine for second axle:
880 kW, 10 kN·m from 0 to 692 rpm
max. speed 2,320 rpm



Fig. 3: Coupling the test specimen

The HBM torque calibration machine...

... is designed as a loading unit with a lever arm and a tension train. A reference measurement chain was provided by a Z4A reference transducer in conjunction with an MP30DP digital amplifier. The calibration machine can be used alternately for all four measuring points.

Conclusion

The test rig is a forward-looking solution, both for fatigue testing and for service life trials, as well as for testing the functionality of rear axles for trucks and coaches.

High-precision and dynamically correct measurement with torque flanges right on the drive train are the optimum conditions for providing a metrological solution. ■

measurement technology