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Kistler News

Vehicle Dynamics & Durability

Leading technology for increased performance.

Get Better. With Kistler.

New Extra Class in the RoaDyn® Segment.

Successful start for the RoaDyn S6XT Reinforced series.

New system expansion on target

With the S6XT Reinforced wheel force transducer, Kistler has successfully introduced a new quality product for heavy-load wheel force measurement. Thanks to the experience gained in a long-term research project, Kistler has been able to develop a commercially viable product. Once again, Kistler has demonstrated its performance capability in the area of wheel force sensors.

RoaDyn S6XT Reinforced with System 2000 wheel electronics

Mechanical and electronic challenges

Industry standards placed on wheel force measurement, such as the analysis of wheel forces in vehicles subject to heavy loads, are becoming increasingly more complex.

In response, Kistler launched a project to meet these rigid demands through close collaboration with one of its customers. The following primary challenges were quickly identified:

- To transfer the high loads (250 kN), Kistler's calculation department needed to analyze the wheel using FEM methods in order to enable it to find an optimal design between weight and durability.
- This new type of drive hub geometry, with a large diameter and corresponding rim geometry, had to be combined with the standardized Kistler wheel electronics to ensure that the force and angle measurement data is safely transmitted.

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New Extra Class in the RoaDyn® Segment.

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By bringing together expertise from the customer side and from Kistler's side, a wheel system could be quickly modeled that met the demands of the vehicle to be inspected.

Modularization – standardization
The key to this success was the modularity of the RoaDyn S6 wheel force transducer system, which allowed for further development of groups of modules. After careful testing, they were successfully integrated into the series. Modularization refers to the design of a system that is built upon multiple, flexible modules. These modules can be combined with one another in virtually any way and therefore present a multitude of complete solutions.

Using the synergies offered by the standard RoaDyn S6 construction kit, it was possible to produce the S6XT Reinforced series in a very short period of time.
To meet the challenging requirements in the heavy-load context, groups of components were thoroughly tested and subject ed to enhanced development:

- The load measurement cells needed to be reinforced in order to expand the load area of the wheel force transducers. Based on many years of experience and Kistler's expertise, the existing measurement cells were further developed. A new measuring cell was produced, which is now being used in other applications and wheel force projects.
- Due to the wheel geometry, the energy supply for the interior data transmission had to be realized using a battery. Short-term hardware modifications were necessary and the firmware for the System 2000 had to also be expanded in order to maximize the battery life.

Calibration for highest demands
Kistler has been able to apply top technology to the calibration process as well.
The on-site hexapod offers the chance to calibrate the four 42-inch sensor elements of the S6XT Reinforced sensor systems. By having a partial-area calibration, the compensation matrix for the orthogonal direction is determined and then programmed into the System 2000 so that the compensation can be directly implemented into the signal processing.

Kistler Hexapod –
multi-component calibration system

Summary and future prospects
The RoaDyn S6XT Reinforced series has expanded the Kistler wheel force transducer product family with yet another element suitable for the heavy-load context.
By combining expert knowledge, standardized components, customer-specific designs and effective project management, an optimal customer solution was developed within a short period of time and has already proven itself through a variety of measurement applications.
Furthermore, various customer requests from both the special-purpose vehicle sector, as well as the truck sector, have shown that RoaDyn S6XT Reinforced series will not be restricted to only this particular project. Countries such as India and China, in particular, have increased demand for reinforced wheel force transducers in order to conduct series trials there.

RoaDyn® S6XT Reinforced and RoaDyn® S625 Carbon

Wheel Force Sensors for Permanent Use Under the Toughest Conditions.

RoaDyn S660-nsp

RoaDyn measuring hubs make vehicle tests safe even under extreme climate condition tests

Vehicles and their components must be capable of meeting impeccable climate changes and demands globally. Whether in the warm, humid climate of an equatorial country, or throughout a continental winter with persistent frost, the vehicle must function without errors. To meet these requirements, development vehicles are tested in representative countries at various stages. This requires extensive logistic outlays and external factors, such as the weather, in order to influence the objectivity of the measurements.

To circumvent the risk factors and to increase the efficiency of the vehicle and component testing, more and more experiments are conducted under the fully controlled conditions of a test laboratory. Comprehensive testing stations with climate chambers for testing temperature and humidity are used, and special installations that can generate salty sprays at low temperatures are constructed. For the tests, extensive apparatuses and measuring devices must be integrated, which can function reliably in the conditions of the surroundings over a long period of time.

Kistler recognized the trend towards increasingly detailed modeling of real driving conditions in a test laboratory and developed a reliable solution for the RoaDyn hub sensor used on vehicles and the axle test stand.

The sensor boxes and mechanical elements are made of stainless materials, even in the standard version, in order to meet the specifications of worldwide test drives. Modification of the requirements for a current test stand version is also based on standard components and, consequently, can be implemented with a high degree of flexibility and minimal effort. With this customer-oriented approach, for example, a climate-proof design for an entire vehicle climate chamber (temperature and humidity variant) and a corrosion-proof version (salt spray mist) of axle test stands have been realized.

Climate and corrosion-proof test stand applications are among the most important, unique selling points of RoaDyn wheel force sensors.

Vehicle Validation in the Development Process – An Example of Application: Rear Axle Steering.

The development times of new vehicle models are shrinking. At the same time, there is a growing multitude of vehicle variations in order to appeal to the largest number of possible consumers with one and the same platform. The globalization of our world increases demands on the automotive industry to bring newer models or technologies onto the market more rapidly. Modern measurement technology gives users the ability to quickly validate developments and to conduct comparative measurements with other vehicles.

Kistler provides customers with the solutions from one source. In addition to the development and sale of modern measurement technology, Kistler also offers expert and global consulting. Worldwide product training and seminars for specific applications provide complete system solutions for customers – from the selection of suitable sensors and measurement data collection, all the way to application training and evaluation and analysis of the measurement data.

Testing dynamic drive on a racing stretch

Practical example of "validating supportive rear axle steering (rear active steering)"

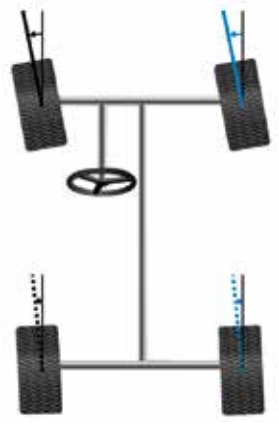
Modern top-class vehicles increase comfort with active rear axle steering, for example. In city traffic at low speeds, for instance, the rear axle steering can be controlled so that a smaller turning radius is created, making parking easier for the driver.

Figure 1 shows the function of the rear axle steering using a left curve. The wheels of the front axle are turned left while the rear axle turns right. The result is that the steering radius compared to a fixed rear axle is smaller.

Picture 1: Wheel position at low speed

When changing lanes at high speeds during highway driving, the rear axle is controlled so that the steering direction of the rear wheels matches that of the front wheels.

Figure 2 represents a left lane change. The direction of the wheels on the front axle and rear axle are identical in this case.



Picture 2: Wheel position at high speed

The validation of such steering systems is one of many examples that show the various possibilities that Kistler measurement technology provides.

- The wheel vector sensor RV-4 is positioned to measure wheel movements in the X, Y, or Z direction as well as the steering angle turn and wheel
- The Correvit® S-350 speed sensor allows vehicle speed and the side slip angle to be measured and thus the speed-dependent steering angle changes to be evaluated
- A rotation rate sensor identifies the turn movement of the vehicle affecting the driver
- All of these measurement dimensions are collected by the CDS Logger data acquisition

Kistler supports users from the start of testing by assisting with the selection of the components, providing product and vehicle equipment training, as well as offering assistance while conducting the experiment itself. Kistler is assisted by external experts in the area of automotive testing and drive dynamics for the analysis of the vehicle testing and evaluation of the results. On-site support, calibration and restoration of measuring technology top off Kistler's scope of services.

In Diagram 1, the curve progression for a lane change at low speed is visible. The steering angle of the front axle, with the FR_Toe and FL_Toe signals, exhibits a contrary steering angle compared to the rear axle with the RR_Toe and RL_Toe signals.

Diagram 2 shows an identical steering angle mark for the front axle (FR_Toe and FL_TOE) and rear axle. The result of this is that the vehicle's turn about its own vertical axis is minimized. The driver thus experiences a more stable and comfortable drive response.

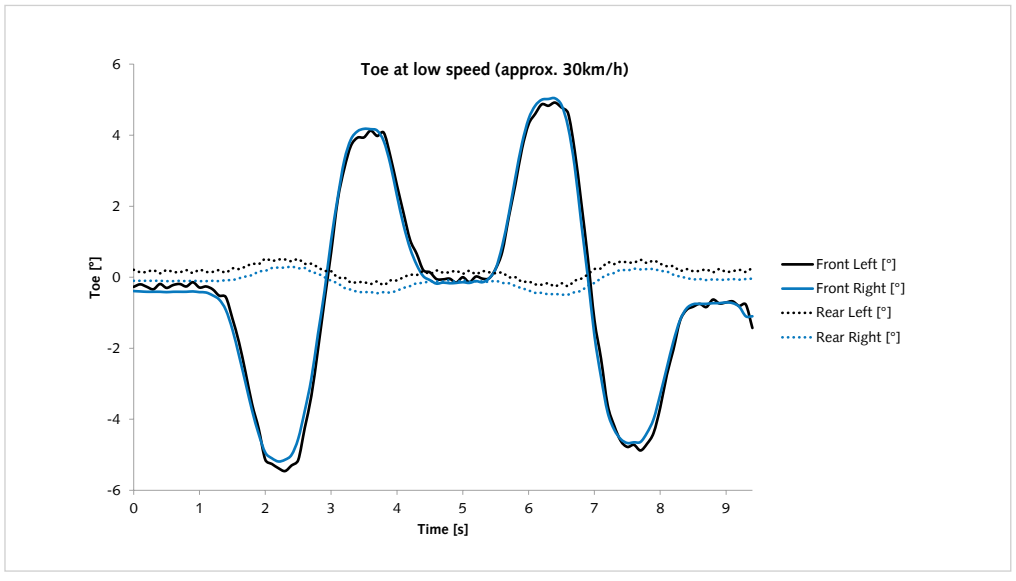


Diagram 1: Lane change at approx. 30 km/h

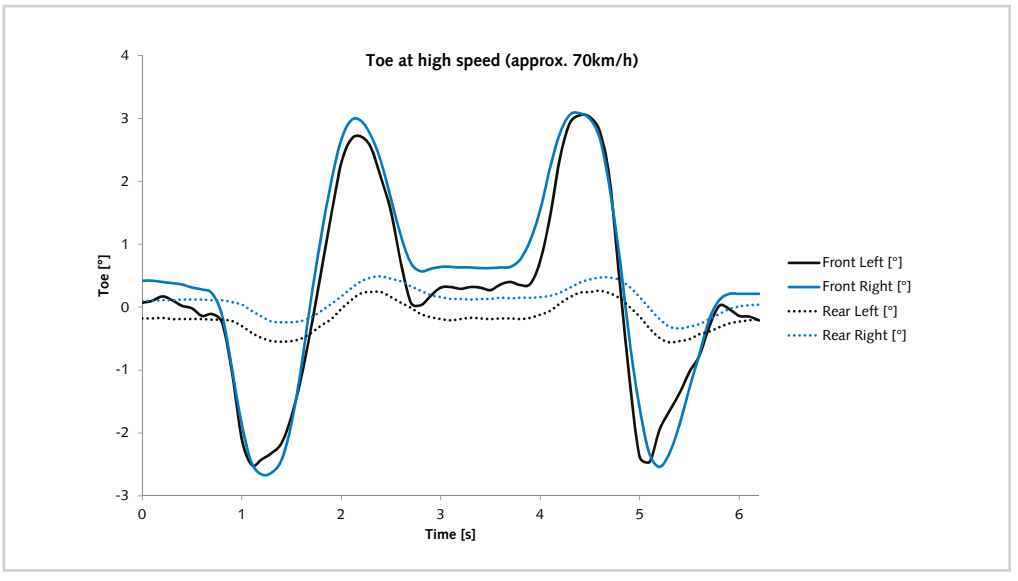


Diagram 2: Lane change at approx. 70 km/h

Carbon Wheel Endurance.

25 Years of Carbon Fiber Usage in Road Load Data Acquisition and Vehicle Dynamics

Wheel force sensors for gathering load data for test drives as well as for monitoring testing stations, so-called "traffic simulations", have become a key element of the development and testing process for the automotive industry.
The weight of the 6-component sensors plays a central role, particularly in terms of the quality (i.e. objectivity and accuracy) of the data collected. Lightweight construction has become the highest priority in the area of unsprung mass in the vehicle.

The idea of a lightweight wheel force transducer made of carbon fiber-reinforced material became realized more than 25 years ago at the University of Stuttgart and was advanced by Kistler. The design of the wheel force transducer structural element is distinguished by a high degree of stability and low weight. The selected sandwich structure, with shrunken or threaded rim rings of aluminum, guarantees a high degree of resilience in all situations during demanding vehicle testing. The durability of the carbon wheels was optimized with the help of the numerical simulation and confirmed in multiple experimental tests. In addition, the quality processes and procedures were defined so that the measurement accuracy and the safety of the sensors could be evaluated over their operating life. Last but not least, the sheer number of wheel force transducers in use for more than two decades have confirmed this successful concept.

The increasing vehicle weight, the steadily growing size of rims and the electrification of the powertrains present this unique construction with new challenges. The weight advantage over aluminum or steel sensors and the associated measuring quality, as well as the efficiency, remain the driving force for further development work. At the same time, users are increasingly willing to appreciate the technical highlights and potential of fiber-reinforced wheel structural elements in more and more situations and to consequently put them to use.

The name Kistler has been synonymous with a passion for technology and proven customer-oriented solutions for 25 years.

RoaDyn® S625 wheel force transducer in combination with Kistler vehicle dynamics sensors: DCA System for dynamic camber angle measurement, Correvit® SFII Sensor for transverse measurements and the RV-4 wheel vector sensor.

New RoaDyn® Rental System for Maximum Flexibility.

RoaDyn® Rental System
with RoaDyn® S625, S635 and S650

RoaDyn wheel force transducers are preferred measuring devices for vehicle dynamics measurement applications or for the acquisition of operating loads.

Kistler recognizes the challenges to our customer's development schedules and has responded by created an expanded, modular RoaDyn rental system designed for maximum versatility and faster delivery.

Three distinct RoaDyn sensors are available for various load classes in the area of passenger car applications: S625, S635 and S650 – for corresponding measuring ranges from 20, 35 or 50 kN (max. vertical load). For this purpose, the sensors are calibrated in combination and pre-assembled.

The rental system is designed in such a way that a uniform pitch circle diameter on the rim permits a simple combination of sensors and rim sizes. Currently, rim sizes of 7,5 x 17, 8,5 x 18 and 8,5 x 19 inch are available. Of course, Kistler will be able to provide other rim sizes upon request.
A simple combination with optical sensors for determining the side slip angle, dynamic wheel angle or speed are possible (among other things), in addition to a combination of the wheel vector sensor RV-4, for determining the wheel position in relation to the body.
These measuring technologies are also available from Kistler as a rental system.

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