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レーシング・テクノロジー

THE NEW BREED

THE TECHNOLOGY SHAPING A BOLD NEW ERA FOR THREE MAJOR CATEGORIES

PANOZ DP01 CHAMP CAR

LE MANS COUPES

NASCAR CAR OF TOMORROW

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TAKING THE LOAD

From F1 to NASCAR, torque sensors to spring and torsion bar raters, William Kimberley considers some of the latest innovations in test systems

FOR race engineers, crew chiefs, suspension engineers, manufacturers and OEM technicians who need to characterise dampers and springs quickly, accurately and reliably, Roehrig Engineering offers a family of linear test systems, damper dynamometers and spring rating equipment.

With nearly 950 systems installed and operating worldwide since 1990, the company, based in North Carolina, is a leader in damper dynamometer technology.

It produces two standard electro-magnetic actuated test systems capable of meeting varying wave form needs that are able to run any user-defined wave form with 1.0 micron encoder accuracy. It also currently offers six models of damper dynamometers and spring and torsion bar raters that can work in conjunction with any of its damper dynamometers as well as fully functioning standalone units.

Over the summer, though, it has launched the advanced spring rater, a tool for rating valve springs.

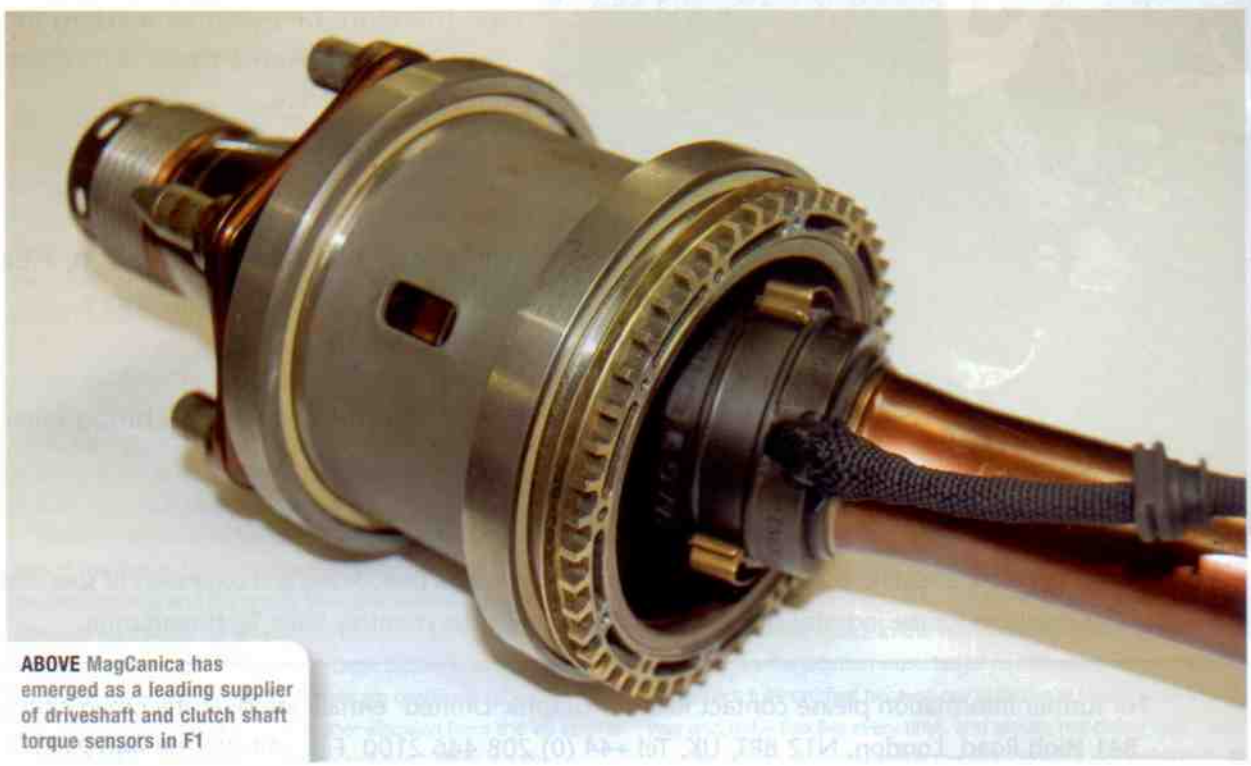
"One of the things it can give you is a continuous data stream of valve spring rate versus either stroke or load which many people need for their simulation programmes," says Kurt Roehrig, founder and CEO. "Some of the valve spring manufacturers in the US virtually commissioned us to build this. They saw the way that we collected suspension spring data and where it could be of help to them in the design of valve springs. Now some of the upper level NASCAR teams are beating our door down so they can use the data from the simulation.

"We built the first unit to be based around valve springs and it has about a 75mm active stroke and about 4500 Newtons capacity loadwise. However, we can build them up to 100 kilonewtons and at least half a metre of stroke so we will be able to take software control algorithms and apply them to the full range of suspension springs up to Humvees or military vehicles."

IT'S ALL TORQUE

MagCanica is a California-based, high technology, design and development company with niche manufacturing facilities that was founded in early 2000 by Sami Bitar and Ivan Garshelis.

The company has now grown to 10 employees and since its inception six years ago has focused its efforts on the



ABOVE MagCanica has emerged as a leading supplier of driveshaft and clutch shaft torque sensors in F1

ABOVE This advanced valve spring rater is in demand from leading NASCAR teams

development and commercialisation of its breakthrough, magnetoelastic polarised band technology for torque measurement.

It can draw on the extensive technical background of a group of talented Stanford University and UC Berkeley engineers and scientists. Expertise in magnetomechanics, mechatronics, embedded controllers, sensors and actuators has enabled MagCanica to develop and now commercialise an accurate, robust and highly sensitive magnetoelastic torque sensor for high-performance automotive and aerospace applications. As such, it has emerged as the leading supplier of driveshaft and clutch shaft torque sensors for Formula One teams.

It was in early 2001 that an F1 team approached MagCanica to discuss its torque measurement needs. It was interested in the technology but sceptical that it could operate reliably and consistently on its racecar. It therefore contracted MagCanica to an initial prove out Phase I project, to instrument its F1 engine dynamometer with a MagCanica torque sensor and to compare its performance with the instrument-grade torque sensor on the test cell. Within four months, MagCanica had custom-developed and successfully delivered a torque meter system for the engine dyno, proving not only the feasibility of the technology but also the highly improved dynamic response of the signal as compared with the reference system.

Based on the positive results of this project, the team contracted MagCanica to a multi-year Phase II development effort to develop custom torque sensors for three new applications. These were for a single cylinder engine dyno torque sensor, an in-vehicle driveshaft torque sensor and an in-vehicle clutch shaft torque sensor.

> "Some of the upper level NASCAR teams are beating our door down so they can use the data"

Each application presented major challenges and significant technological barriers that had to be broken. Additionally, each developed system had to be reliable and accurate enough to be considered raceworthy, such that it could be used as an input to the racecar's onboard computer to assist in controlling the vehicle.

As a result of this Phase II programme, the client renewed its commitment and contracted MagCanica to a multi-year Phase III agreement to supply it continuously with in-vehicle driveshaft and clutch shaft torque sensors. New products in the pipeline include both camshaft and crankshaft torque measurement. The company now boasts that it has four F1 teams on its books using various torque sensing products.

"We are now looking at Champ Car and IRL as well as NASCAR," says company president Sami Bitar. "We are finding that our torque sensors are proving to be very valuable to some teams but there are others who are less certain as to their value. As ways of testing, measuring and evaluating torque in various applications, we believe that our magnetoelastic polarised band technology for torque measurement supplies the goods."

NEW TECHNOLOGIES

LMS, the engineering innovation company based in Leuven, Belgium, has announced the launch of LMS Virtual.Lab Rev 6.

This new release introduces an advanced and unified modelling environment, integrating all the required model creation and simulation tools to perform accurate system-level performance analyses. This solution eliminates the tremendous effort needed to create individual models for separate disciplines, and allows easy and smooth cross-attribute analyses.

Rev 6 provides multiple innovative technologies and 64-bit data processing support, making it more practical to handle complex models with high accuracy, while significantly reducing calculation times. The programme also marks the introduction of a new value-based licensing system, giving users flexible access to the full portfolio of LMS Virtual.Lab applications.

Furthermore, Rev 6 offers new and completed applications for structural analysis, acoustics simulation, noise and vibration prediction, system dynamics analysis and durability simulation, and extended automation and customisation capabilities.

With Rev 6 LMS delivers a unified ▸

LEFT Rev 6 opens up new application areas for virtual simulation

modelling environment for a complete car or any other complex mechanical assembly. It offers extensive capabilities to build full-system simulation models flexibly starting from multiple component and sub-system models.

Working from a single data model, users can efficiently analyse the system's behaviour in multiple performance aspects like dynamic stiffness, strength, noise and vibration, durability, vehicle ride and handling or the dynamic performance of mechanical systems. This saves time and avoids the accumulation of modelling errors and inaccuracies. In addition, the unified modelling solution allows easy and smooth cross-attribute analyses.

These accelerating technologies open up new application areas for virtual simulation and allow users to model and analyse specific performance phenomena in much greater detail. As an example, LMS Virtual.Lab succeeded in processing a vibration analysis based on 600,000 high-resolution Frequency Response Functions of a 4-component wind turbine assembly in less than three hours. This type of analysis is required to qualify the vibration performance of the wind turbine reliably, but would be extremely cumbersome and practically impossible to run without the 64-bit support.

The new Wave Based Substructuring (WBS) tool assembles the structural model as a compilation of the reduced FE models of individual parts and expresses the deformation of the coupling interface in the form of basis functions called waves. This considerably reduces the computational workload and quickly analyses the impact of multiple design modifications. To automate the meshing of complex geometries, Rev 6 introduces a new H-meshing tool that allows users to create a full tetra or hexa-dominant mesh. Virtual.Lab Structures also gains new capabilities to assemble, trim and analyse full vehicle models using a variety of connection modelling techniques.

The new Advanced Mesh Morphing solution expands the morphing capabilities with control blocks to fit the shape of the car and to reflect any feature lines.

Amongst its many other features, LMS Virtual.Lab Motion Rev 6 further enhances its CAD contact capability by providing the tools to define easily CAD solids and calculate the interacting contact forces. The new Standard Contact tool offers an innovative way to represent contact points and requires dramatically less computation power. This strongly accelerates the simulation of large models consisting of thousands of contacts.

Rev 6 also introduces a new FE Load Transfer capability, which allows users to conveniently apply the loads from any selected time step of a dynamic FE-driven multibody simulation to a structural component model that is used to investigate component stress. Automating the error-prone process of linking the correct loads to the right connection points on the structure translates into considerable time savings and contributes to more reliable stress analyses.

In addition to the Vibration Fatigue solution allowing fatigue calculations based on spectral loading (PSD) instead of only time domain data, Rev 6 extends LMS Virtual.Lab Durability with a new Acoustics Fatigue solution that determines the stress distribution and durability performance that result from a random sound pressure.

This application is particularly tuned to cover the simulation requirements in the space industries, where development teams have to monitor the damaging impact of deafening rocket launch noise on the payload, the satellite and the many fragile electronic components.

Next to this new application, LMS Virtual.Lab Durability gains a set of new tools and features to increase further the efficiency of durability simulation. For example, the new load contribution analysis tools support users in identifying the loads that contribute most to the local damage or local high stresses.

> "Significant technological barriers had to be broken"

These insights provide clear guidance in refining a mechanical design for better strength or fatigue resistance. Furthermore, new automation tools allow users to automate complete analysis set ups fully with extensive loads schedules consisting of hundreds of events.

"The fully integrated and multidisciplinary unified simulation solution in Virtual.Lab offers distinct benefits over a simulation process based on single point solutions," says Willy Bakkers, vice president and general manager of the LMS CAE Division. "Recent customer benchmarks have delivered time gains in the order of 30 to 50% in simulation time, while reaching considerably better simulation results and more valuable engineering insights in the performance of new designs."

"LMS Virtual.Lab provides multiple innovative technologies like Waved Based Substructuring, Fast Trim Modelling or advanced CAD Contact for multibody simulation, which make it more practical to handle complex models with high accuracy, while significantly reducing calculation times," says Jan Leuridan, LMS executive vice president and chief technical officer. "In addition, it delivers 64-bit data processing support with Rev 6, providing the required processing power to handle extensive and highly detailed simulation models easily." ■