

Mesys

EXAMINES INFLUENCE OF ELASTIC HOUSING DEFORMATIONS ON THE LOAD DISTRIBUTION WITHIN ROLLER BEARINGS

Elastic housing deformation can have an impact on the load distribution within rolling element bearings. For many applications this is neglectable, but for large bearings or soft housings, it can be of interest to consider this effect.

The MESYS shaft system calculation could take into account housing stiffness based on a global matrix or an import of a STEP-file or a FEA-mesh for several versions. The housing stiffness was considered as one node at the center of each bearing ring. The ring itself was still cylindrical or has user defined deformations.

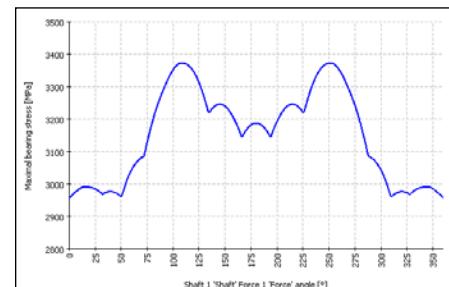
At Hannover 2018, MESYS AG presented a preview of the MESYS shaft system calculation, which considers a coupling between housing deformations and deformations of bearing rings. The housings can be imported as STEP-model or they can be defined parametrically for simple rotation symmetric cases. The STEP-model is then meshed and statically reduced. Optionally a modal reduction is possible too.

This simple example shows first a deep groove ball bearing in a rectangular block, which is fixed at the bottom side. The bearing is loaded horizontally.

On the left the deformations and the load distribution with consideration of elastic deformations of the bearing ring, on the right one the averaged deformation of the housing is considered with a circular bearing ring:

The maximum contact stress is 3285 MPa with elastic ring and 3175 MPa with rigid ring. The horizontal displacement is 0.052 mm with elastic ring and 0.051 mm with rigid ring. The vertical displacement is 0.01 mm with elastic ring and zero with rigid ring. The vertical uplift is only visible using the elastic model. As comparison the horizontal displacement without housing stiffness, which would be 0.032 mm.

While the contact stress is independent on the load direction using the rigid ring, there is a dependency of contact stress from load direction using the elastic ring:

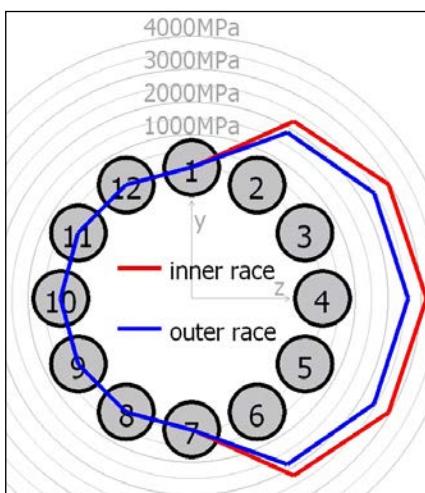
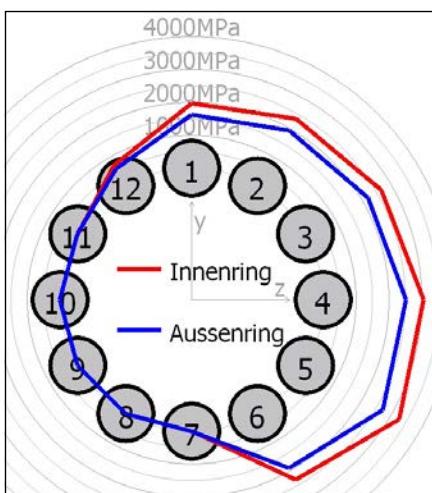
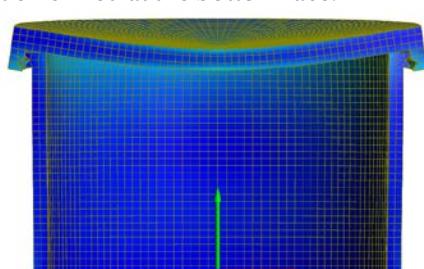
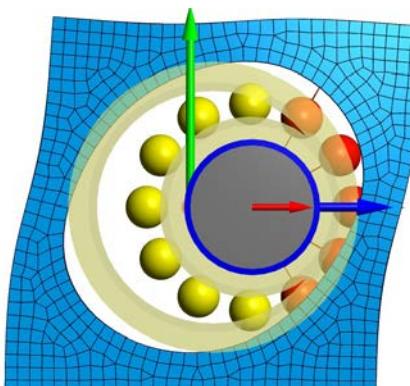
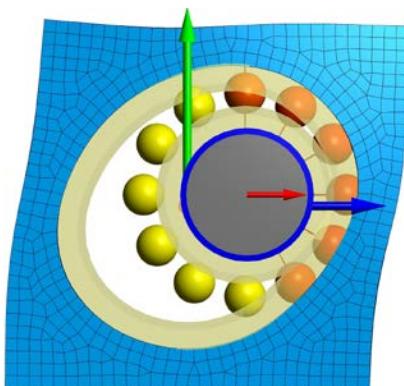


With a force angle of 0° (force to the top) the lowest contact stress results, while the maximum stress results at about 110° load direction. The overlaid variations in the curve have their reason the fixed positions of the rolling elements in the calculation.

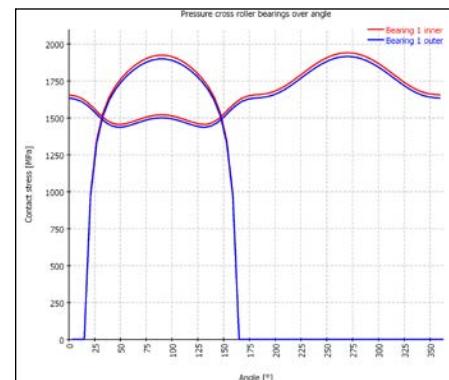
For this example, a bearing clearance of zero was considered. Using a larger clearance would lead to higher contact stress for the cylindrical ring.

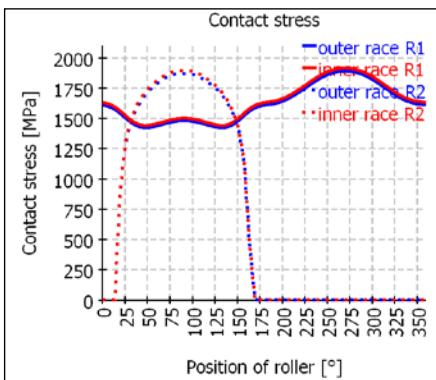
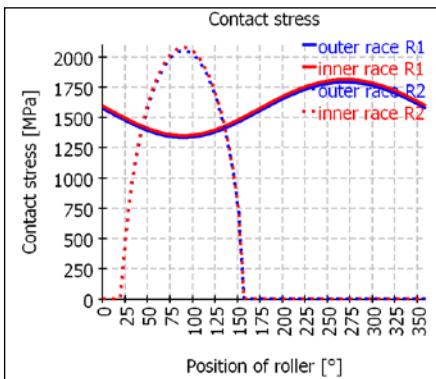
Cross roller bearing example

As second example a cross roller bearing under axial, radial and moment load is considered. The loading acts on the upper surface and the lower cylinder is fixed at the bottom face.



The contact stress is shown for three cases. First a full calculation with 3D solid elements without reduction, then for a bearing with rigid rings and a calculation with reduced FEA-model in the shaft system calculation.





The maximum contact stress is 1941 MPa for the full 3D-model, 2078 MPa for the bearing with rigid rings and 1917 MPa for the reduced model. A larger difference is seen at the rolling element forces which are 3734 N, 4540 N and 3719 N.

The curves for the contact stress for the two elastic cases in above diagrams show the same shape with maxima of both races at the same level. In case of the rigid rings one race sees a higher contact stress. A comparison of the axial deformation is difficult because of the large deformation of the top. For the radial displacements there is a result of 0.03 mm for the rigid case and an average radial displacement of 0.2 mm (0.19 mm) in the elastic cases (the average value is determined differently in both cases).

In many cases the deformations of the bearing rings lead to a larger load zone and therefore to a smaller contact stress.

The full 3D-model is a little software than the reduced model as the reduced model uses the same tilting angle for both races in a ring. The reduced model does currently only consider global ring deformations, but no deformation within the ring. This is a special case for a cross roller bearings as it contains two rows.

A calculation using the full 3D model

takes a little more than 3 minutes, while a calculation for one load case of the reduced model only takes less than a second. The full 3D-model would allow to consider nonlinearities like contact, while the reduced model is a linear stiffness matrix only.

A preview version was available at the Hannover Fair, the final version with coupling of housing stiffness and elastic ring deformations will be available with version 08/2018 this fall.

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Faulhaber

OFFERS MICROMOTORS FOR MEDICAL APPLICATIONS

Diabetes is among the most common diseases in today's societies. If the disease is not treated in time or treated incorrectly, important organs, such as heart, eyes and kidneys could suffer serious damage. Chronically ill patients can optimally control their treatment with an insulin pump – supported by micromotors from Faulhaber.

There is, in fact, a relatively recent technological development that should considerably simplify life for diabetes patients: the insulin pump. The patient wears it directly on the body. It constantly delivers a small quantity of insulin to the blood; the additional insulin required at mealtimes can be controlled by pressing a button. It does not eliminate the need for patients to estimate their carbohydrate intake, but it is a huge relief for most users in daily life. It is even already in use by small children and can be remotely controlled by parents.

Though available from various manufacturers, the design of insulin pumps is always similar: an ampoule contains the insulin, which enters the body as needed by means of the battery-operated pump via a catheter and a cannula. A small motor pushes the plug of the insulin ampoule forward via the threaded rod, causing insulin to be released. Extremely high demands are made of the motor: In order to keep down the weight of the wearable device the motor must be compact,



and as a rule the diameter must be no more than about 10 millimetres. The motor must be reliable and precise, since too little or too much insulin is harmful to the patient. A human life may even depend on the reliability of the motor that is used. Since the insulin has to be injected into the body every few minutes, the motor must start and stop at regular intervals. In addition, the motor must operate in a very efficient manner due to its battery operation.

In order to fulfil all of these high demands, insulin pump manufacturers rely on the micromotors from Schönaich. Various motors produced by Faulhaber are used here: Motors with precious-metal brushes, brushless motors with 2-pole technology and stepper motors. The 0816...SR series is an example of micromotors with precious metal commutation. The brushless DC-servomotors of series 0620...B and 0824...B have an extremely long service life. Precision dosing control is possible here using the analogue Hall sensor. Some manufacturers rely on the stepper motors of series AM 0820 or AM 1020.

The insulin pump is primarily used by diabetes patients as a wearable medical pump, but other application areas are emerging—patients with other chronic illnesses such as Parkinson's disease or immunodeficiency are also reliant on regular injections. Faulhaber stepper motors of the AM 0820 series are already in use here.

For more information:

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Maxon

OFFERS EXOSKELETON JOINT ACTUATOR

Maxon Motor has developed an exoskeleton drive for use in robotic limbs. This complete joint actuation unit consists of a pancake brushless DC motor with inertia optimized rotor. Also included is an internal high resolution encoder, planetary gearbox with absolute encoder and a position controller with CAN and RS232 interface. Fitting absolute encoder directly at the joint rotation provides designers increased positioning accuracy. The unit delivers 54 Nm of continuous torque and 120 Nm on a 20 percent duty cycle and may be operated on supplies between 10 and 50VDC and the actuation speed is up to 22 rpm. Other key features include: compact housing, integrated controller and reduced weight and cost.



For more information:

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www.maxonmotorusa.com

Bonfiglioli

OFFERS ROBUST AND COMPACT WHEEL DRIVE FOR HYBRID AERIAL PLATFORMS

The 605WE wheel drive, designed and developed by Bonfiglioli, has been created in cooperation with one of their customers for a new innovative hybrid aerial platform. Bonfiglioli 605WE, which provides an output torque of up to 10.000 Nm, is a 3-stage gearbox with a fully-integrated 8 kW electric motor and parking brake that guarantees maximum efficiency and compact size. The integration of all the components in an optimized space gives the machine builder the opportunity to benefit from a cost-effective solution easy to maintain. Thanks to the direct-mounting flange, it is also easy to install. The 605WE series perfectly adapt to both

hybrid and electric applications. The special degree of protection (IP67) and the special painting coupled with high torsional resistance wiring makes it suitable for four-steering wheel vehicles, even in harsh environmental conditions faced in any construction site.



For more information:
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www.bonfiglioliusa.com

Drake Motorsports Development

OFFERS HIGH PERFORMANCE POLYMER PARTS

Drake Motorsports Development, LLC was recently formed to accelerate the availability of track proven race parts and to continually develop new racing products from a racing industry insider perspective. The first part developed is an offset control arm bushing machined from Torlon 4435. The bushing delivers an increased static negative camber range of adjustment for the front wheels, which is used as a suspension tuning method to optimize tire contact under high lateral loads. Tyler Quance, owner of Drake Motorsports Development, and the engineering manager for Drake Plastics, has been racing a Spec Miata with a set of these bushings since mid-2017. During this time, the bushings have shown no measured wear. The bushing material is self-lubricated and requires no grease, making a totally maintenance-free, non-consumable part which is intended to last as long as the racecar.

The bushing was designed in collaboration with Chris Haldeman and X-Factor Racing of Princeton, Texas. This collaboration resulted in a decision to supply the bushings already installed in control arms with a steel anti-rotation dowel pin to ensure each bushing stays in place under demanding race conditions, and to finish ream the offset hole after installation for a precision fit with the steel inner sleeve. This process saves the customer a great deal of time and hassle during installation and ensures the bushing set is aligned to deliver maximum available front wheel camber in a ready-to-bolt-on assembly.

The extreme wear resistance and excellent lubricity of Torlon 4435 provides the combination of improved performance and improved part life. This grade and suspension bushing application supplied previously by Drake Plastics, has a pedigree with the Risi Competizione Ferrari race



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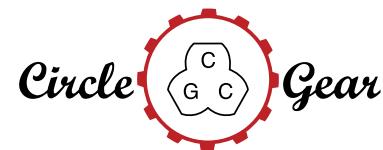
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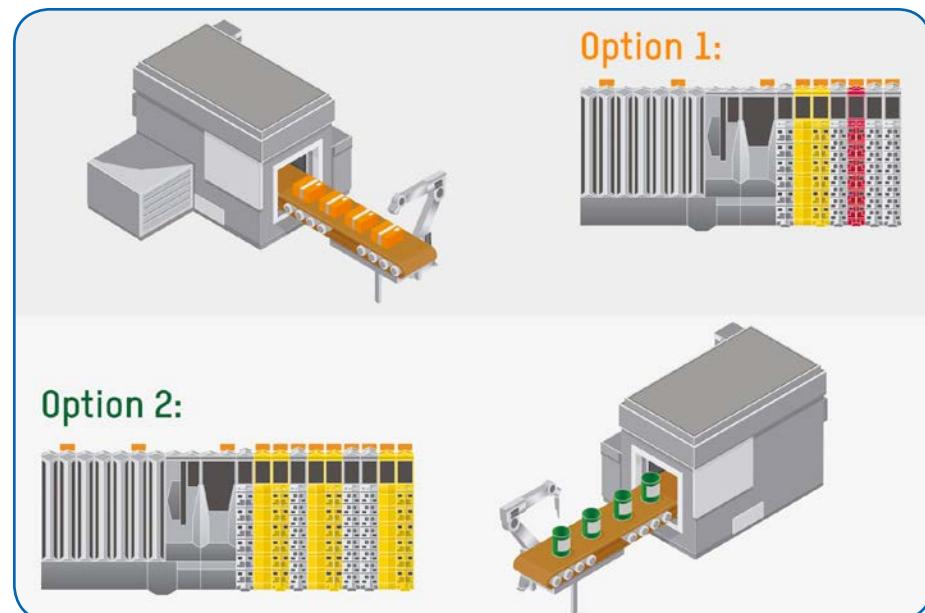
Partnership with Quality Reducer to provide
Gearbox repair, rebuilding and reverse-engineering.

team. Now that Drake Motorsports Development is assembled to expand the accessibility of Torlon 4435 bushings as performance aftermarket parts, Torlon is poised to obsolete traditional bushing materials in higher-end performance and racing applications. According to Quance, "once drivers and race prep shops try Drake Motorsports Development's Torlon 4435 suspension bushings, I expect they will want to use them exclusively."

The second part launched by Drake Motorsports is a high-performance polymer transmission shift bushing machined from Torlon 7130. Prototypes were run in 3 different cars for the NASA Spec Miata Eastern States Championships at Sebring in September 2017 with excellent results. According to Bret Synder, lead crew member for Drake Racing and driver himself, "the shift bushing is almost a forgotten part until it becomes a problem from excessive wear or breakage." The thermoplastic bushing maintains the impact-absorbing characteristics of the OEM Mazda bushing other aftermarket metal replacements cannot. This means internal gearbox components remain isolated from severe hard-shifting impact as designed by Mazda. Torlon 7130 is one of the strongest and most durable polymers making what is generally accepted to be a consumable part one which now lasts indefinitely.

For more information:

Drake Motorsports Development, LLC
Phone: (281) 255-6855
www.drakemotorsportsdevelopment.com



B&R Automation

SIMPLIFIES MANAGEMENT OF MACHINE VARIANTS WITH SOFTWARE TOOLS

Modular applications can now be implemented even more easily. B&R's new software component, *mapp IO*, makes it possible to add I/O modules at any time. This can happen before a machine is delivered or even at runtime, thereby greatly simplifying the task of managing variants of machinery and equipment.

With *mapp IO*, I/O configurations can be generated directly from an ERP or order management system. No engineering tools are required, even if third-party drives or modules

are added. Additional variants and options are configured directly on the machine using *mapp IO* and then programmed using *mapp CodeBox*. With *mapp CodeBox*, you can program options in ladder logic without affecting the machine's primary application. The machine can be commissioned without having to modify the original machine software.

For more information:

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Phone: (770) 772-0400
www.br-automation.com

Aerotech

INTRODUCES ECO SERIES LINEAR STAGES

Aerotech's ECO-LM and ECO-SL series linear stages combine high performance and rugged mechanical design in a cost-effective, economic package. A comprehensive choice of direct-drive linear motor, rotary servomotor, or stepping motor versions is available across 44 models with travels from 50 mm to 800 mm, plus vacuum and cleanroom versions.

The ECO-LM series direct-drive linear motor stages are optimized with high precision, noncontact linear encoders. The precision noncontact encoders enable minimum

incremental motion to 10 Nm with micrometer-level repeatability. The optional HALAR factory calibration improves positioning accuracy to $\pm 1.5 \mu\text{m}$. The ironless forcer coil provides high force with zero cogging for smooth velocity and position control, ideal for applications requiring outstanding contour accuracy and smooth velocity profiling. The linear motor has zero backlash, no windup, zero friction, and excellent dynamic responsiveness. ECO-LM stages are available in 17 different models with travels ranging from 100 mm to 800 mm and



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speeds up to 2 m/s. Configurable cable management solutions are available for single and multi-axis systems as standard options.

For even more cost-sensitive applications, the ECO-SL series includes several NEMA 23 stepper motor and brushless servomotor options. The ECO-SL series is designed with many standard features and options that make the design adaptable to specific applications. Several encoder options provide electrical resolutions ranging from 0.5 μ m down to sub-nm. A holding brake can be added for vertical applications. A motor fold-back kit is available for space-constrained applications to reduce the overall stage length. ECO-SL stages are available in 27 different models with travels ranging from 50 mm to 800 mm and speeds up to 300 mm/s.



For more information:

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Miki Pulley

STEP-FLEX COUPLINGS ELIMINATE RESONANCE IN BALL SCREW ASSEMBLIES

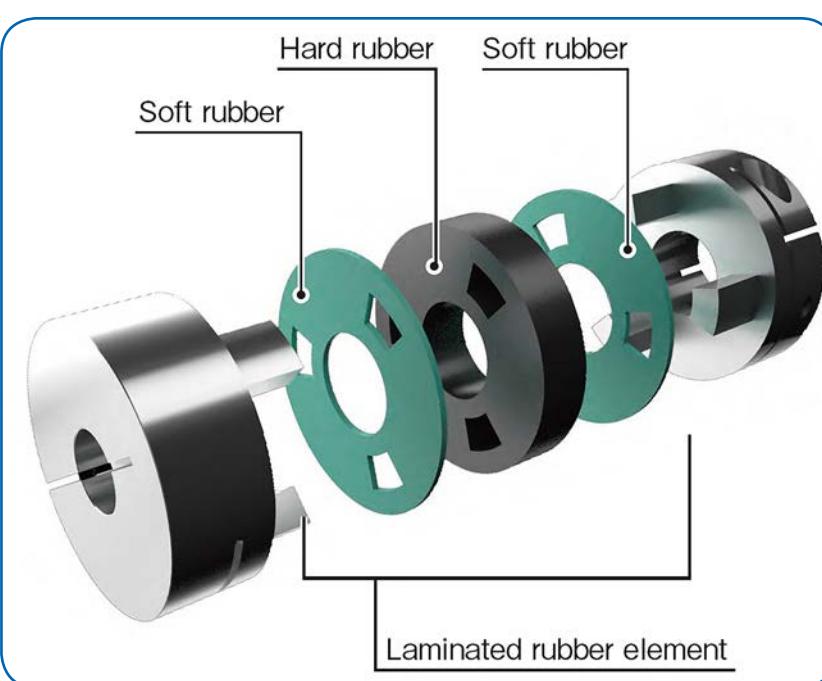
Miki Pulley's Step-Flex Couplings improve ball screw performance while solving resonance and vibration problems. The Step-Flex is an altogether new class of shaft coupling. The Step-Flex coupling design has a two-part elastomer element combination. This assembly dampens vibration caused by the actuator carrier when struggling to find its home position by making small adjustments in rapid sequence.

With this design, the hard (black) element is separated from the aluminum alloy hubs by a softer (green) elastomer disc. This combination maintains adequate torsional stiffness for precise positional accuracy while still allowing for minimal angular and parallel misalignment, and absorbing vibration. The power-transmitting element, consisting of different hardness layers, also achieves a reduction in counter force generated by misalignment. This can greatly reduce the load on the bearing - resulting in reduced heat load.

Another key feature is the electric and temperature isolation provided by the coupling's elastomer element. This mitigates conductive heat transfer from motor to output shaft, important in rotary motion applications. Plus, it also halts stray voltage traveling on the shaft. Applications include automation of all types where ball screws are used including packaging systems, semi-conductor assembly systems, laboratory automation and medical equipment.

For more information:

Miki Pulley
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Hansford Sensors

LAUNCHES COMPACT AND LIGHTWEIGHT TRIAXIAL VIBRATION SENSOR

Hansford Sensors, a developer and manufacturer of high performance industrial accelerometers, has launched a compact and lightweight 100m/Vg triaxial vibration sensor. Called the HS-173, the new accelerometer is a side entry device, can be used in both on- and off-line applications and has been introduced to enable OEMs, vibration analysts and end users to measure vibration in three axes simultaneously. This makes it ideal for use across a range of industries, including process, mining and quarrying, automotive, paper and metals manufacture.

With an operating sensitivity of 100mV/g and a transverse sensitivity of less than 5 percent, the HS-173 is one of the most compact triaxial accelerometers on the market and ensures measurement time can be reduced due to the simultaneous reading of three axes. This, combined with its excellent frequency response of 6 Hz to 6 kHz, makes it ideal for monitoring vibration in a variety of machines, from fans, motors, pumps, compressors and gearboxes, to conveyors, process equipment and spindles on machine tools.

The HS-173 is a robust and reliable industrial accelerometer, weighing just 250g, protected by a stainless steel casting that is sealed to IP67, and capable of operating at temperatures ranging from -55 to +140 °C. Installation is quick and simple, via a standard M12 connector, either temporarily for off-line data monitoring with a handheld data collector, or online as part of an integrated condition monitoring system.

The HS-173 forms part of Hansford Sensors' extensive range of industrial accelerometers, which includes 4-20mA, AC and AC/Velocity sensors, vibration modules, enclosures, switch boxes and cables and connectors.

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