Precision Manufacturing and the Digitalization of Linear Motion Technology

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Digitalization is increasingly transforming mechanical engineering and manufacturing technologies, bringing with it not only unparalleled control and flexibility over production systems but so much more.

This digitalization is transforming linear motion technology of the future, incorporating sensors and communications technology that provides real-time mechanical performance data.

This data gives engineers new opportunities to integrate the data into their digital workflow. They can implement its application to help manufacturers achieve new levels of precision in the way they machine parts, assemble components and move products through multiple manufacturing stages.

Machine manufacturers are currently experiencing a profound generational change. Engineers and designers in their mid-30s have grown up with cell phones and the internet. Digital technology plays a very strong role in their private lives and how they view the power of instantly accessible, real-time data to help them live their lives.

This is also increasingly affecting the professional use of technology. The new generation seeks concrete solutions for automation processes and functions rather than components and systems. They assume that all applications, information channels and platforms should be connected and as easy to use as those in private life. This also applies to the selection, dimensioning and configuration of linear motion technology.

Far from being a basic mechanical technology, linear motion technology is poised to transform the modern manufacturing environment over the next several years. This impact could be in several manufacturing areas, including configuration, ordering and commissioning, operation, diagnostics and maintenance. This is because of all the software tools, online services, intelligent systems and integrated sensors available to support the creation and integration of digitalized linear motion technology.

Digital engineering tools and configurators will intuitively guide system designers more rapidly through all the engineering steps to create linear systems, saving hours or even days of time.The future will see further simplifications in this area, too, including interactive websites with chat facilities. To complete their designs, the users will work directly with the digital twins of the components and systems they configure.

The manufacturers of linear motion technology components and systems face a dual challenge. First, mechanical performance data remains the decisive criterion for the use of components. To achieve the improvements in precision and manufacturing process control envisioned by Industry 4.0, linear motion technology suppliers need to incorporate intelligence into many facets of their systems that, up till now, were purely mechanical or physical.

For example, some manufacturers are supplying each linear module or axis with a digital identity. Digitalized linear motion systems will have module data readily available for commissioning – including all axis data. Users benefit from a plug-and-play commissioning process without having to input data or correct source errors.

The axis parameters can be stored digitally in different products. Whether in a motor encoder, integrated measuring system or digital nameplate, the axis parameters will always be available. The relevant parameters will be

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transmitted to the drive system, saving time and minimizing errors during start-up and maintenance. This is just one way digitalized linear motion technology can help contribute to precision manufacturing.

As the use of this technology increases, it will be easier for the machine's key data to be picked up by integrated sensors and passed on to cloud services during operation. In real time, these sensors will constantly supply all operating and environmental data, such as temperature or vibrations. The sensors can be integrated, for example, in screw drives or they can be attached externally to the axes and connected via open interfaces.

An integrated, decentralized intelligence uses algorithms to derive the state of wear from this data, thus enabling condition-monitored maintenance of linear axes. Machine availability, quality, efficiency and other such key information will flow into Overall Equipment Effectiveness (OEE) data to ensure everyone is always well informed – wherever they are – and able to react quickly.

By evaluating sensor data, companies will be able to see future indications of necessary maintenance and service tasks. Enhanced service and maintenance will be a key part of the future of linear motion technology. These advanced services will evaluate the data pulled from machine operation and explain what maintenance, servicing and spare parts are required to prevent unwanted downtime. As a result, this allows manufacturing equipment and processes to function most efficiently.

Incorporating sensors and other smart technology into the next generation of linear motion systems will better serve the needs and operational expectations of the next generation of automation engineers who use digital technologies in their daily lives. Just as importantly, digitalized linear motion technologies will give machine builders and manufacturing end-users the smart, connected systems they need to enhance the precision manufacturing capabilities of the Industry 4.0 factories.

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