

Motion Control Makes OEM Products More Flexible, More User-Friendly, More Marketable

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Electronic motion control has been a well-accepted technology in the machine tool industry for more than two decades. The need for precise, repeatable performance and higher production speeds easily justified the cost of the CNC motion controller and servos.

These systems have now reached a level of technical sophistication, value and marketing acceptance that allows the OEM designer the freedom to use them without the uneasy feeling of operating on the outer edge of technology. The integration of modern motion control into OEM products improves the quality of the items produced by these machines, and increases the marketing acceptance of them. OEM machines using motion control produce parts more precisely and repeatably, while making the machines much more flexible and user-friendly. Throughput is often increased, diagnostic abilities are enhanced, and the machines can be reconfigured with a minimum of skilled labor. All of this translates into higher sales and more satisfied customers.

The maturing of motion control has attracted many solid OEM companies to invest in it and apply it to the products they sell others. This market expansion has raised the bar for all motion control suppliers, and has increased industry-wide reliability and cost-effectiveness. And the explosion of software-driven products of all types has noticeably enhanced the acceptance of motion control integrated into OEM products. By offering machines and systems whose abilities and functional configurations can be changed through software control, OEMs can meet the exact needs of their customers without having to resort to custom designs. Standard products can be manufactured in larger quantities, thereby lowering prices and raising quality.

Strengths of electronic motion control

Although anything that moves in an OEM machine is a candidate for conversion to electronic motion control, not every opportunity can be cost justified. The OEM engineer must recognize where to apply this technology. This process begins by knowing the strengths of motion control; these can be applied to overcome a weakness or trouble spot in the OEM equipment, or to offer improved functionality to increase sales potential.

- Motion profiles are precise, smooth, repeatable, and have controlled acceleration and deceleration.
- The motion control trajectory shape is very flexible, ranging from traditional linear segments to S-curve minimum jerk profiles to complex shapes.
- The trajectory of motion can be changed on the fly based on process stimuli.
- The motion control system can follow, or synchronize to, other equipment that is not driven by a motion control system.
- Many axes of motion can be precisely synchronized, one to another, or all to a single master.
- The phase relationship between two synchronized axes can be easily changed. This is similar to a mechanical differential.
- Complex synchronized motion - electronic cams - can be changed at setup or on the fly, resulting in much greater flexibility than steel cams.
- Choice of Master axis and Slave axis can be made at start up or on the fly.
- Since the motion control system knows the precise location of each axis at every instant, this positional information can be used to do high speed registration by trapping the position of an axis when a sensor trips. This information can be used to realign the product to the proper position.

- Torque/force during motion or at rest can be monitored to provide process data.
- Torque/force can be selectively limited to allow the system to stall on a jam up or to run against a hard stop for zeroing or to act as a clamp.

There's more than just motion control available from motion controllers

One of the strengths of electric motion control: software control of master slave functions. Because modern motion control systems are designed around microprocessors and other computer-based technology, they can handle many more tasks than just motion control. Additional functions typically include....

- I/O sequencing
- Analog I/O
- Programmable limit switch functions
- Operator interface
- Communications links to PLCs and host computers
- Gathering process control data for ISO-9000 conformance or SPC
- PID loops for process control
- Local and remote diagnostics

Increased machine throughput

Motion control systems are often used to increase machine throughput. For example, using an air cylinder or clutch brake to provide movement results in uncontrolled acceleration and deceleration if machine speed is increased. At some point these uncontrolled motions cause unacceptable vibration and wear. With motion control, the accel/decel rates are precisely controlled and the top speed is increased. The motion profile can be made proportional to machine speed to replace the clutch and eliminate wear surfaces.

Another technique is to eliminate start-stop motions completely. Why bring a part to rest to work on it when a motion control system can synchronize to the part while it's moving? A simple example is a machine that cuts a web into sheets. In a purely mechanical system the web is indexed, stopped, cut with a stationary knife, and reindexed to start the process over. But it can be modified using motion control to cut the web to a precise length with a rotary knife while the web is moving, often at very high speed.

Many processes like die cutting, embossing and cutoff require that printed matter be lined up or registered with the next operation. This can become an interesting challenge with a mechanical system, because of the changing phase relationships among the various moving parts. This often slows the process considerably. In an electronic motion control system a sensor is used to sense the position of a mark on the material and adjust the downstream processes to align with that mark. This ability to phase adjust on the fly can be extended to using software filters to smooth the adjustments in very sophisticated ways. The speed of adjustment can be very precise and very fast. And interestingly, it is often more limited by the sensor than the motion control system.

Applications abound

In general, if your OEM machine uses a mechanical cam, differential phase shifter or gears to produce synchronized motion to a lineshaft, a motion control system can be used. And your machine will be much more flexible.

Applications that require putting glue on complex shapes, routing or sewing can take advantage of motion control's ability to go directly from CAD to motion control. A particularly good example is the bedding industry, where motion control now allows an artist to design a comforter sewing pattern without the need to cut expensive, long lead time metal cams. Winders are also a common application for motion control, along with machines which notch, punch, index, rotate, etc. Packaging and handling equipment are also strong candidates.

Is Motion Control For You?

Electronic motion control has come of age in the last few years. Where once it was only considered for machine tools and other very high end applications, it should now be seriously examined for nearly all OEM machines whenever designs are undergoing revision or new models are planned. Component costs are steadily decreasing due to standardization and growing volume. Capabilities and quality - already very high - are increasing as well. Most motion control suppliers offer excellent applications assistance, training and software engineering to support their products - and yours. Many local distributors and systems integrators are bringing motion control products into their lines, so local help can often be arranged.

The electronic motion control marketplace is experiencing explosive growth in both sales volume and breadth of product offerings. There is no reason to wait to apply this easy to use technology to your OEM machines. Choose your motion control supplier carefully, then go for it. Your customers - and your bottom line - will thank you for it.