Right-Sizing Your Motion Control System Can Improve Energy-Efficiency

Mike Cromheecke, marketing manager for Kinetix Motion Business, Rockwell Automation

Manufacturers are always looking to improve energy efficiency, which effectively improves their bottom line. The manufacturers who are successful in this endeavor seldom go it alone. They enlist help from their machine and equipment builder (OEM) partners. Whether developing a simple or complex machine, an optimized design is critical for creating machines that not only run with greater efficiency, but more quickly adapt to market changes and integrate with up and downstream operations. By leveraging mechatronic design tools and scalable, right-sized automation, OEMs can develop the sustainable, energy-efficient systems their customers need.

Use Mechatronic Design Tools

Mechatronics is a multi-disciplinary design approach relying on the collaborative application of motion design software and products. Using this approach, mechanical, electrical and control engineers can easily analyze, simulate, optimize and select motion control systems through virtual prototyping.

These digital simulations help engineers find errors early in the design process. Furthermore, engineers can input design information in a familiar environment and understand how their design decisions affect the system as a whole, allowing them to quickly evaluate design alternatives and select the best fit.

For example, look at a recent issue at a garage door manufacturer. An electrical engineer simulated a motion application and found the drive running at 90 percent. He automatically thought, “Wow! I am using almost all of my torque. The motor I have chosen is the right size.” However, the mechanical engineer had selected an oversized gearbox with a pulley system to convert rotary to linear power. When the engineers re-simulated the application using Motion Analyzer software from Rockwell Automation to build the application from the ground up, they were forced to ask themselves, “How much energy is required to just move the garage door, taking out all the steps we think we need to get there?” Meaning, they didn’t need to measure how much power was needed to run an inefficient gear box. The software suggested they use a lower kilowatt-rated linear thruster motor. Because the kilowatt rating on the motor translates to a larger drive as well, reducing the motor size removed energy losses coming from a series of oversized and unnecessary components. Energy usage for the application as a whole was cut in half.
Mechatronic design software – such as Motion Analyzer 6.00 from Rockwell Automation – helps OEMs obtain the full benefits of a mechatronic design approach by allowing engineers to conduct a virtual design review and identify opportunities to optimize the efficiency, performance and size of the solution.

Whereas in the past, analysis required to right-size system components was so time intensive it proved prohibitive, information to design and build a more efficient, cost-effective machine is now available at your fingertips. Furthermore, the new design programs are changing the landscape of machine building by enabling OEMs to find performance limitations in a virtual environment.

The programs take performance and Total Cost to Design, Develop and DeliverSM into account – even before the commissioning phase begins – to offer faster and more cost-effective solutions to design and sustainability issues.

Evaluate the Tradeoffs

Design programs, such as Motion Analyzer and SolidWorks – a 3D mechanical CAD program from Dassault Systèmes – can work together to evaluate the tradeoffs between materials, size and safety of components, and available motion systems. This helps OEMs keep machines small and energy-efficient.

In the past, the appropriate sizing of a mechatronics solution could only be verified after the machine was built. The time required to consider alternatives prohibited optimization and as a result machines were frequently overbuilt. Virtual Design allows machine builders to conduct engineering analysis on the mechatronics solution in a virtual environment prior to physically building the mechanisms. This not only speeds the time to develop, but also allows for a more optimized solution.

For example, Motion Analyzer 6.00 software can analyze energy costs to run a machine for a year – and how much money more energy-efficient products can save you. The software computes load weight with motion profile – how far and fast a load must travel. It can then compute energy spend per axis when users input cost of kilowatt hours (kWh) and machine uptime for one year.

Take a rotary motor machine that runs on 11 cent per kilowatt-hour energy for 50 weeks each year, five days a week, and eight hours a day. The rotary motor will cost $315 per year per axis to run. Switch the rotary motor for a linear motor and cost is reduced to $200 per year per axis – significant savings for machines having hundreds of axes.

Take Advantage of Scalable Offerings

Mechatronic design software can also help engineers save time and money by properly sizing control equipment, as over- or under-sized components can add unnecessary expense. Implementing scalable, right-sized control systems can help OEMs meet a variety of end-user needs in a cost-effective, design-efficient manner.

Scalable offerings are designed to meet a wide variety of application needs while providing a platform that can operate on all machines – complex to simple. Scalability helps reduce total cost of ownership by enabling OEMs to use a single design environment across a wide range of machines. They can also reuse code, HMI faceplates and design best practices from system to system. This saves time during design, development, commissioning and maintenance after the sale.

For example, JANDA Company Inc. – an OEM that specializes in manufacturing resistance welders – realized several benefits from implementing a scalable solution based on the Logix control platform from Rockwell Automation. The company was able to reduce design time by 25 percent, reduce commissioning time by 25 percent, improve installation time by 30 percent, improve tolerances from one-eighth inch to one-tenth-thousandth inch, reduced control panel size by 50 percent and reduced overall maintenance time through the implementation of scalable automation.
JANDA is able to match the control requirements of each end user through the use of scalable solutions that provide more efficiency and sustainability. Ultimately, the end user benefits through reduced waste and energy and maintenance costs. End users can also scale the automation up to meet growth needs in the future, without having to retrain workers or recode equipment.

**Designing a Better, More Sustainable Machine**

Used collectively, mechatronic design tools and scalable automation helps enable OEMs to design and deliver the more efficient, sustainable machines required in today’s global manufacturing industry.

Motion Analyzer is available as a free download at [http://ab.rockwellautomation.com/motion-control/motion-analyzer-software](http://ab.rockwellautomation.com/motion-control/motion-analyzer-software).

Total Cost to Design, Develop and Deliver is a trademark of Rockwell Automation Inc.