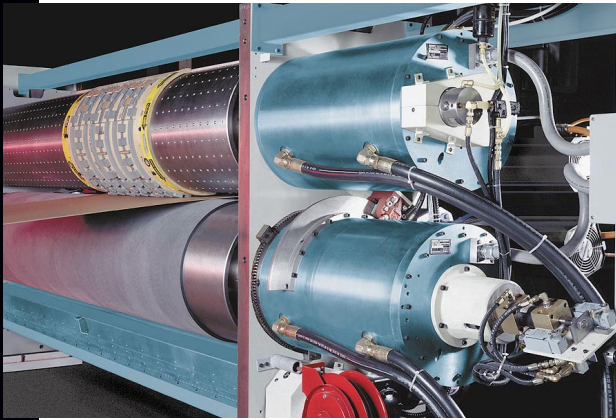


VisSim

Motor Supplier Improves Machine Design with VisSim Modeling & Simulation Software



Machine builders throughout industry are under pressure to provide higher throughput, greater accuracy, higher reliability (uptime) – all at lower cost. For the motor supplier, this is an important opportunity to play a role in the machine design. The supplier's expertise in motor requirements and capability can lower the expense of designing a machine and shorten the design cycle.

Indramat frameless motor



The Challenge

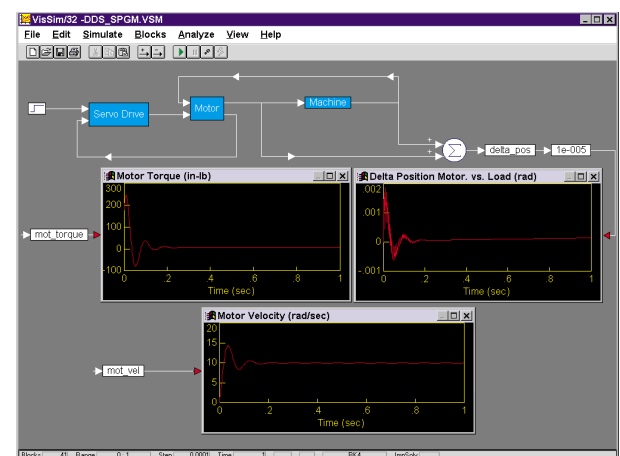
As a supplier of servo motors, drives and computer controls, we at Indramat gain a substantial competitive advantage by proving to our customers that the motors and drives we select will achieve the required performance criteria, without forcing them to build an expensive prototype or spend months evaluating the equipment. Our competitive position depends not only on the quality of our products, but also on our ability to deliver the exact performance specifications required by our customers. Our customers are machine builders who use our servo products to perform motion control in a variety of applications, ranging from high-speed spindles to low-speed rotary tables.

Consider the customer who requires a certain bandwidth (a measure of how well the real-world application follows the control command). The customer doesn't want a bandwidth lower than what he needs, but he can't accept a higher bandwidth either, since that increases cost and unnecessarily loads the system. We don't want to supply a motor whose torque and velocity are so strong it will excite resonances in the machine. Given the mechanical load, the mass of the customer's machine, and other factors, we determine the appropriate motor and drive, along with the exact set of control parameters.

We have to guarantee to the customer that these parameters will deliver the required performance bandwidth. Until recently, we provided that proof by testing the components in our lab. We would take the selected motor and drive from stock, connect them to a large steel wheel having the same mass as the customer's machine and then run tests for half a day.

"VisSim's easy-to-use interface and sophisticated simulation engine not only boosts the productivity and quality of control system design, but also minimizes costs for everyone. VisSim is intuitive and visual, with a block diagram approach that closely emulates the way a control engineer looks at the world."

William M. Erickson, Engineer: Indramat Division of Rexroth Corporation



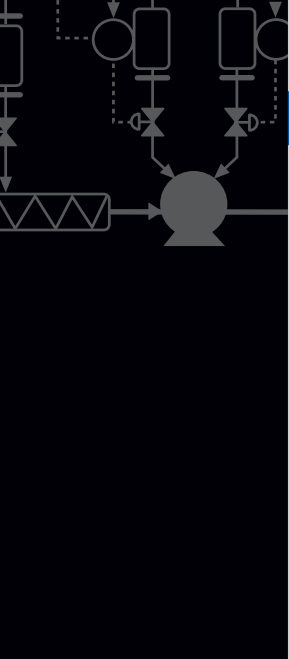
VisSim model of a motion control system comprising servo drive, motor and machine mechanics. The plots depict the system's response in terms of torque, velocity and position variation caused by step change in commanded velocity.



Visual Solutions
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Modeling The Future

Application: Servo Motor / Motion Control



The Solution : VisSim

An alternative to this time-consuming process would be to run simulation software to test the components. *Initially we were not encouraged by the simulation software we had tested... until we learned about VisSim, an interactive Windows-based modeling and simulation software program.* VisSim provides a visual block diagram interface instead of lines of text. The flow of the diagram, such as summing junctions and gains, is graphically depicted on the screen. Blocks and connections are assembled with a classical control perspective.

We liked VisSim's ease of use, but we didn't know whether the software could accurately simulate motion control systems. I ran some simulations with VisSim and compared it with our lab results. *VisSim's predictions matched the lab results on enough tests to convince us of the accuracy and reliability of the software.*

I began using VisSim on a regular basis to select the correct motor and drive systems for our customers. The simulations modeled the function of our motor and drive with the function of the customer machine, integrating the mechanical load and electrical properties of the components into a system. *VisSim provided two critical components used in selecting a motor: motor velocity and motor torque. Equally important, I used VisSim to assure customers that the selected motor and drive would give them the performance they required.*

Frameless motor design with VisSim

One of our more critical applications was to assure a customer that the frameless motor technology would provide the solution for optimizing the machine-motor fit of a new machine. Responding to market demand for smaller machine volume, the customer's engineers wanted to downsize the motor volume. Frameless motors seemed the perfect answer. Without a pre-defined frame casing, shaft, bearing structure and cooling package, frameless motors can be as much as one-seventh the volume of conventional framed motors, while achieving the same power rating. They are installed as individual components (a rotor, stator and feedback assembly) and become integral parts of the machine.

The customer's engineers were taking a bold step in attempting to replace the two large conventional AC induction motors and their bulky gearboxes with one smaller frameless motor. However, the customer's management would not provide final authorization for the design until they were confident that the design would perform as predicted by the engineers. To assure management of the motor's performance capabilities, I simulated the machine with the frameless motor, drive and computer control using VisSim.

To design the model, I retrieved block diagrams of frameless motors and drives from previous projects. With minor editing, I modeled the properties specific to the drive, such as its velocity control and current control, the motor's inductance and resistance, torque constant and its conversion of electrical power to mechanical power, and the machine's properties, such as inertia and load.

The Benefits

VisSim's interactive environment enabled me to easily generate dynamic graphs of motor torque over time. I integrated the torque through the machine inertia, which gave me velocity and plotted that to determine how smoothly the velocity followed the command. The shape of this velocity profile enabled me to find the bandwidth. *The result was clear that the frameless motor could perform the required bandwidth.*

Because I was able to guarantee that the motor configuration would meet customer specifications, the customer's management approved the design. The project probably wouldn't have proceeded without VisSim, and I wouldn't have had the time to extensively test the machine-motor configuration in the lab. *But through simulation with VisSim, I completed the testing in a few hours.*

By replacing the conventional motors with the frameless motor, the customer built a machine not only with smaller volume, but with several key advantages: the stiffer frameless motor yields improved product quality, and the options for configuring shafting and bearing structures offer more flexibility. In addition, the cooling system is more efficient and the performance is quieter.

Call now for a free VisSim demo disk: **1-800-VISSIM-1**
or download it immediately from our web site: www.vissim.com

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