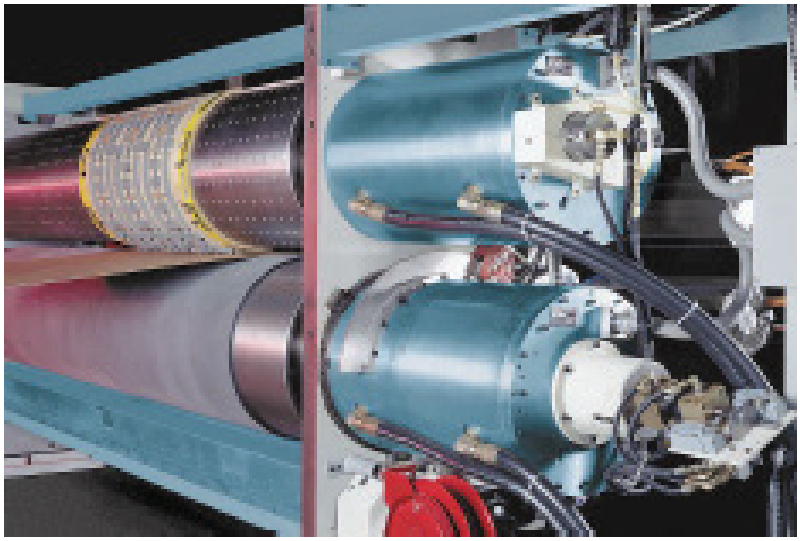
CUSTOMER STORY

The Rexroth Corporation, Indramat Division

Machine Design Improved Using Embed SE



Indramat frameless motor.

"[Embed SE's] easy-to-use interface and sophisticated simulation engine not only boosts productivity and quality of control system design, but also minimizes costs for everyone."

William M. Erickson
Staff Engineer
Indramat Divsion, The Rexroth Corporation

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.

We have to guarantee to the customer that the motor and drive, along with the exact set of control parameters that we specify 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.

Model-Based Design Alternative

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 [Embed SE] (formerly called VisSim).

Rexroth Indramat

INDUSTRY

Servo Motors/Motor Drives

CHALLENGE

Design and simulate a frameless motor as proof-of-concept for the eventual replacement of two large conventional AC motors and their buliky gearboxes

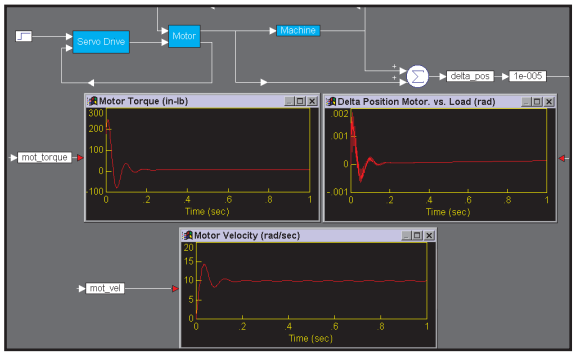
SOLUTION

Use Embed SE to model the properties specific to the drive, including velocity and current control, the motor's inductance and resistance, torque constant and its conversion from electrical to mechanical power, and the machine's properties, including inertia and load

BENEFITS

- Model-Based Design approach minimizes costs
- Ease of use maximizes productivity
- Simulation model assured customer that the selected motor and drive met their requirements

We liked Embed SE's ease of use, but we needed to determine if it could accurately simulate motion control systems. I compared Embed SE simulations with our lab results and found that Embed SE's predictions matched the lab's on enough tests to convince us of the accuracy and reliability of the software.



Embed SE 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.

I began using Embed SE 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. Embed SE provided two critical components used in selecting a motor: motor velocity and motor torque. Equally important, I used Embed SE to assure customers that the selected motor and drive would give them the performance they required.

Frameless Motor Design with Embed SE

One of our 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. 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 wanted to replace the two large conventional AC induction motors and their bulky gearboxes with one smaller frameless motor. However, their management would not approve the design until they were confident that it would perform as predicted by the engineers. To assure management of the motor's performance capabilities, I retrieved Embed SE 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. I easily generated dynamic graphs of motor torque over time, then 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.

Through simulation with Embed SE, I completed the testing in a few hours and assured management that the motor configuration would meet customer specifications. 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.