YASKAWA

Lumber Machine Maker Cuts Wood and Costs with Servo Automation

Move to Servo Control Yields Extra Precision, Productivity

Introduction

A 2x4 piece of pine lumber doesn't usually rank very high on a list of technology marvels. It is the construction industry's ultimate commodity, which is why a leader in the lumber industry is using some sophisticated automation to gain a competitive advantage in this price-sensitive product.

Challenges for Machine Builder

WaneShear Technologies creates the sawmill machinery that puts a finished edge on dimensional lumber to create straight, clean, high grade 2x4, 2x6, 2x8 and larger boards. The equipment created by the Ukiah, CA company has the challenge of processing this consistent product from rough lumber sawn from raw logs, which can vary widely in width and length before entering the edging machinery. The technical challenge is further compounded by a constant need to increase production volumes, made necessary by the pressure to maintain profitability amid fluctuating prices in the volatile construction industry.

Traditional Solution

While automation has long been a part of this equation, WaneShear has been pioneering a different solution. Traditional edging automation equipment made heavy use of hydraulic components.

- Hydraulics deliver the powerful, high torque output the application demands, but often result in leaks of hydraulic fluid.
- Spilled fluid can damage the lumber and make it unacceptable for sale.
- Fluid can also combine with sawdust to create a sticky substance that gums up machinery and makes cleanup difficult.

Raw Lumber

Input to Machine

Output From Machine

Usage

A New Approach

“We knew that by switching from hydraulics to servo automation, operators could solve a lot of our problems,” noted Ron McGehee, President of WaneShear, chief designer of the company’s equipment and the holder of 25+ patents on sawmill related inventions.

“In the past we didn’t look very carefully at servo automation because we felt servos wouldn’t have the torque strength to get the job done, and they would be too large to fit in the physical space of our machines without a lot of re-engineering.” This attitude changed in the last few years, as the footprint of servos has been reduced and new, more powerful servomotors have come onto the market. “The time had come for a new approach, and we saw the opportunity to be an industry leader,” he added.

Servo motion also offered an opportunity to improve the precision of WaneShear edgers, which would lead to more usable boards from every log. WaneShear pioneered the use of vision systems and variable frequency drives to stage rough sawn boards for edging. The staging of boards is especially challenging because squaring an irregular board doesn’t always call for a perfectly straight cut. Cutting angles can often vary by +/- 6°, requiring the use of precise camming routines that often must change on the fly to compensate for a variety of board contours. Because board lumber is quality graded, a better quality of cut means the machine’s output can be sold at a higher price.

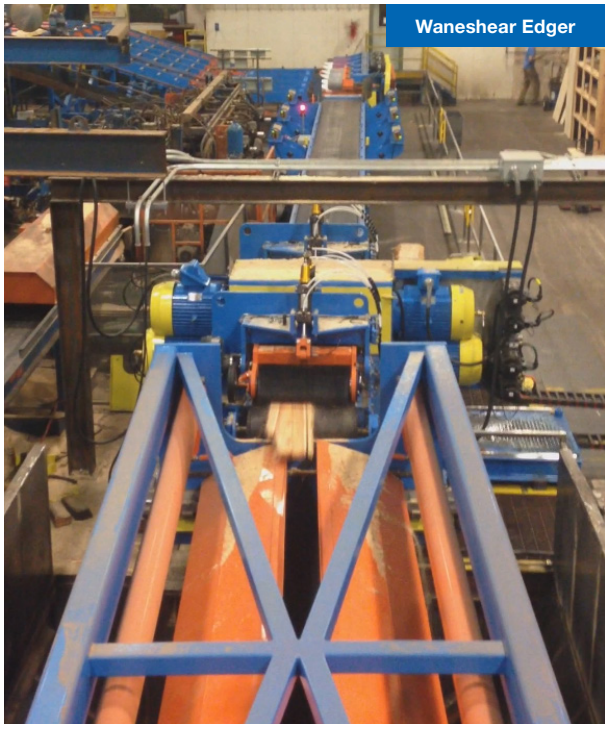
The edgers made by WaneShear must be integrated with the other equipment in a crowded sawmill, which presents a separate set of challenges for automating the edging process. Each edger is customized to fit the available space on a sawmill floor filled with a variety of other equipment, which makes minimizing the footprint of each machine critically important.

> "Linking machines in tight spaces gets to be pretty much essential," said McGehee. "If we can replace gearboxes and hydraulic equipment with servos in the same physical space, we can add capability without adding an integration problem for our customers."

Control system integration is equally important, with most mills using PLC-focused control architecture for their production equipment. “PLCs are the customer’s comfort zone,” McGehee added. “Whatever automation you add, it must integrate with the PLC in a way that gives a minimum of trouble for the guys on the sawmill floor. Otherwise they won’t buy into it.”

Of all the requirements, reliability was the foremost concern in WaneShear’s mind when considering the switch to servo control. Sawmills must run around the clock, 365 days a year to remain profitable.

This desire for reliability led McGehee and the other members of the engineering team to Yaskawa, a motion automation manufacturer with a reputation for servo reliability and a track record for engineering support in challenging applications.

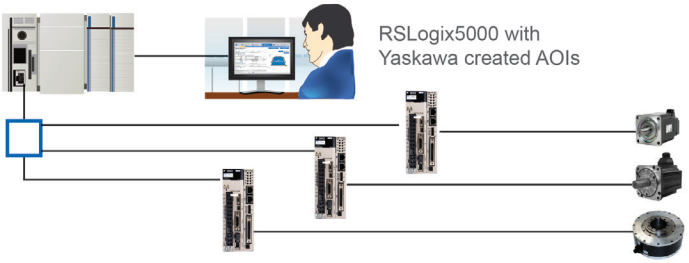


Waneshear Edger

Implementing the Servo Solution

Cam editor tool with MotionWorks IEC software

Yaskawa and WaneShear quickly set to the task of solving the application's technical challenges, beginning with the staging of boards for cutting. The edger's vision system extrapolated each board's position into four position points, which were translated by a Yaskawa MP3200iec machine controller into 1000+ positioning points. The cam editor tool within Yaskawa's MotionWorks IEC programming software was used to create a set of motion profiles, which were used by servo-based conveyors to precisely stage boards for the most accurate edging possible with the least waste.



Add-on-instructions allow users to program servos using a PLC interface

The interface between the PLC and servo axes was made easier by the addition of Yaskawa's add-on-instructions (AOI), which allowed the servo amplifier to be controlled using a standard PLC. Yaskawa demonstrated this first to Waneshear using its SigmaLogic single axis controller, which comes standard with the AOI.

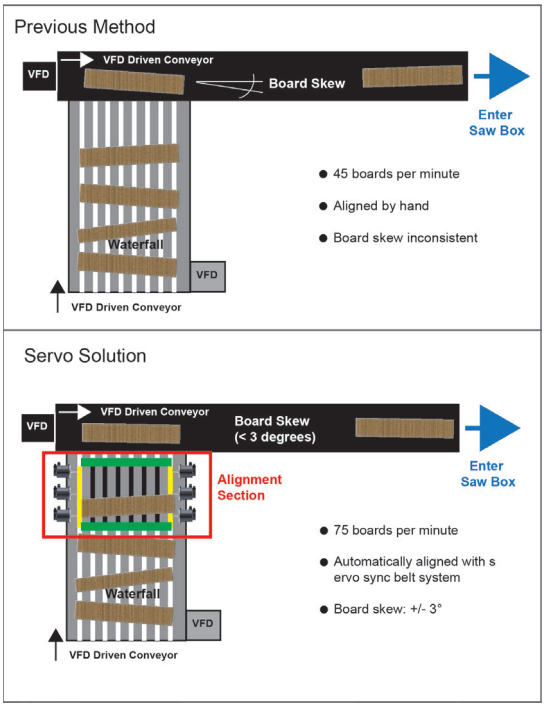
This feature proved to be particularly important for the WaneShear software development team, who didn't want to ask their customers to learn an entirely new programming interface to successfully integrate the new Yaskawa servos. Since the Waneshear application required multi-axis control, Yaskawa engineers developed custom AOI, similar to those in its SigmaLogic product, for its MP3200iec controller, allowing for the usage of the cam editor as well

- Integration of the servomotors themselves proved to be one of the most positive outcomes in the development process.
- The dimensions of the Yaskawa motors made them an easy fit into the spaces once occupied by hydraulic components.
- The torque ratings of the motors suited them well to conveying lumber at the high-power, low-RPM rates needed by a sawmill application.
- The torque density profiles of the Yaskawa servos also made it possible to replace a gearbox on one of the WaneShear machine designs, resulting in a significant savings in component costs.
- The precision of the Yaskawa components allowed WaneShear to reduce following error on its conveyors from 1/8" down to 1/250", allowing the company to shorten the length of its conveyor belts without compromising accuracy of cut.

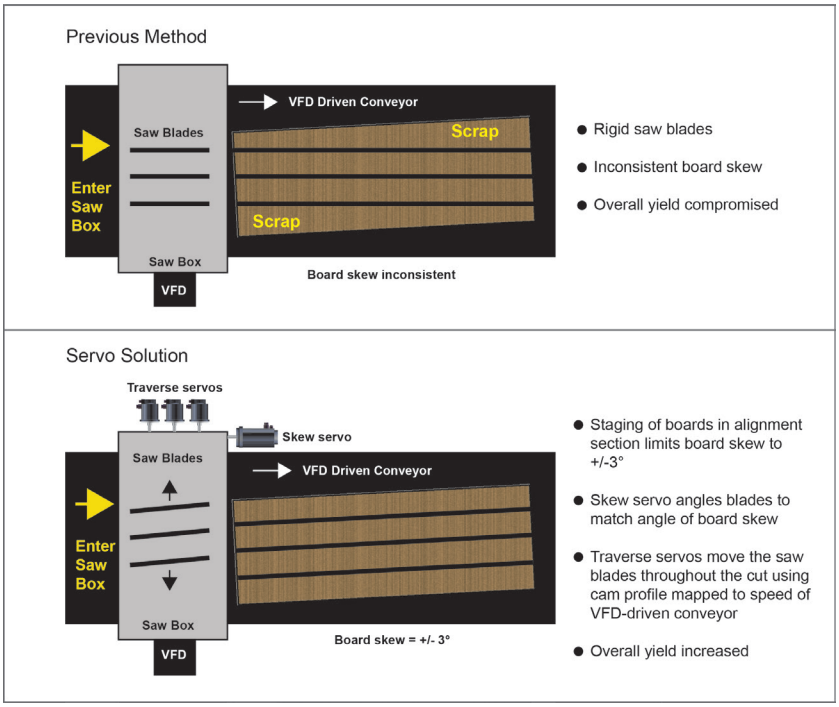
Yaskawa servo and controller technology increased productivity, while decreasing component cost for Waneshear edging machines.

Results

The ultimate proof of the servo's successful implementation was in the edger's ability to reach its performance targets. The goal was to increase output to 75 boards per minute, requiring a cycle time of 800 ms for every board. The design team also expected to improve the quality of boards due to the extra precision of the servo-driven control system. The figures below illustrate board staging and saw box output for the previous solution vs. the servo solution.



Board Staging



Sawbox Output Board Staging

All the targets were met and exceeded. The overall quality of board output increased by 25%, and the new WaneShear servo-equipped edger is processing standard 8 foot boards at more than 20 feet per second, awell beyond the 800 ms goal.

"We've been so successful," noted McGehee, "that now the rest of our customers' plant equipment needs an upgrade to keep up with the edger…which used to be the other way around." He added that the Yaskawa servos and controls are being designed into all future WaneShear machines.

"We are also seeing other machines within our customers' mills using the Yaskawa servo product. It's a sign that we will be working with Yaskawa for a long time to come."

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