YASKAWA

Successful Solution

Web Tension & Inspection
July 24, 2008

Issues / Problems / Challenges
- Require web tension control that minimizes web vibration at all speeds from 2 to 120 ft/min. - Time deadline, previous selected vendor had 8 weeks and couldn't get system working. - Competition was DANAHER.

Solution	
Controller:	Galil DMC4030
Controller Software:	Customer
Interface:	Step/Dir
Servo:	Sigma-5 (SGDV)
Power Level:	400 W, SGMAH
Voltage Level:	230 VAC, 1 Ph.

Performance Achieved	
Throughput:	2-120ft/min
Accuracy:	< 3 micron (on linear axis)
	< 5% torque variation
	< 1% speed regulation
Auxiliary Functions:	Adaptive Tuning

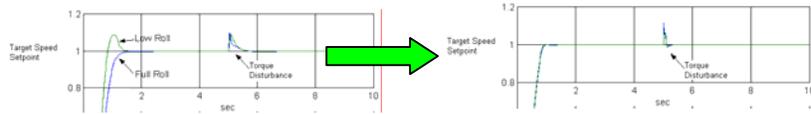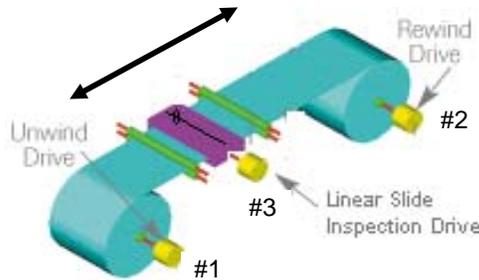| Customer Information	
Industry:	Solar Energy
Application:	Web Tension & Inspection

Galil Control
Step/Dir Signal
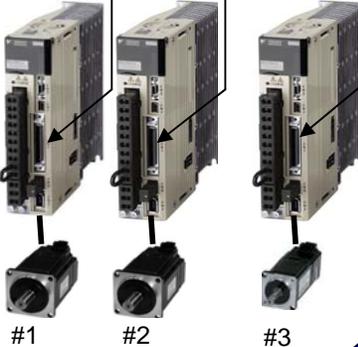
#1   #2   #3

Previous system - unable to achieve at all speeds without retuning servos.

New system - better control of torque disturbances without retuning.

Distributor Comment: *"Cabling and connection to the amplifer was easy. This was the only system that could have been pulled off in this short time."*
OEM Comment: *"These guys did in 1 week, what the other supplier couldn't even accomplish in 8 weeks."*
End User Comment: "Its unbelievable how much progress they made in one week. I'm very impressed"

Application Description

This three-axis machine controls an inline inspection/validation process on a stainless steel web that is later used in solar panel production. A 22" wide by couple thousands of an inch thick steel web is unwound from the pay-out roll and re-wound on the take-up roll. An inspection laser is "zone" positioned laterally by a 3mm pitch precision ball screw to validate the solar film previously adhered to the steel web, and the web is run back and forth through full unwind/rewind cycles until all inspection zones are covered. Inspection data is later used to notch out failed web. The control challenges are: 1) load variation caused by diameter change, 2) requirement for accurate torque control at a wide range of production speeds, and 3) run at different tension settings from 5 to 60lbs --> all of these must be provided without producing excessive vibration in the web. As the diameter changes from 4" to 18", the motor sees from 2 to 19:1 inertia mismatch. The line speed must operate anywhere from 2 to 120 ft/min. Pay-out and take-up axes have 40:1 gearheads and are in a master/slave configuration with master in position mode and slave in torque mode.

An idler wheel with encoder provides secondary feedback to close position loop for the master in upper controller, resulting in a simplified control system (simply jog the master). Analog input for load sensor is wired directly into upper controller.

Differentiating Solution Features	Resulting Solution Benefits
- Product in Stock	- Received & installed within 2 days.
- Adaptive tuning algorithm, 2 min tuning time.	- System was running within spec in 5 days.
- One set of tuning gains valid for ALL speeds!	- Smoothness of motion within the web.
- Anti-vibration filter, 20bit encoder, 1600Hz resp.	- System could handle changing inertia loads
- Technical support from Certified Distributor	- OEM and End User gained significant confidence in the products and support mechanisms.

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