

Web Tension and Speed Control Workshop

Optimation Media Conveyance Facility (MCF)
1600 Lexington Ave., Rochester NY 14606

Abstract

To many people tension control is web handling. Web tension is a critical variable in every aspect of web handling. If tension is too low, you will lose control of process speed, registration, guiding, spreading, and winding. If tension is too high, you may break your web, slip on driven rollers, or magnify thickness variations at winding. If tension varies crossweb, your web will shift, buckle, wrinkle, or break. Tension will also affect curl in laminates and every winding or wound roll defect.

Effective tension control goes beyond tuning individual tension control loops. Tensions must be designed for your product mechanical properties and processing steps. Tension can be controlled by open-loop torque or speed ratio system or by closed-loop feedback from load cell or dancer rollers. A tension zone is created every time you add a speed or torque control element to your process. Many tension zones are not indicated by your control panel, yet are critical to your process. This course will present how to identify or design a tension control strategy by applying the best control option for your product and process step.

Understanding tensioning goes beyond tension control loops. A savvy web handler knows how to visualize the tension variations created by roller and web effects as a shifting contour of machine and cross web direction variations from web bagginess, roller alignment, bearing drag, and roller acceleration.

Unlike any other option in web handling education, the Webhandling.com series of web handling ‘workshops’ are one-of-a-kind training that combines classroom seminars with on-machine demonstrations.

Please join us to discover a unique and comprehensive understanding of web tensioning.

Who Will Benefit from this Workshop?

This two day workshop is directed towards technical employees of any level with a need to understand the fundamentals of machine tension control. Though the seminar will include some engineering theory and equations, the workshop’s primary goal is to show how theory and experiment lead to practical solutions to common problems.

Seminar Outline

The workshop will aim for a 50-50 split between seminar and lab demonstration time. Seminar topics will include all the background needed to understand the lab demonstrations and more, including:

- What is the right tension for a given material? Measuring material properties (thickness, elastic modulus, spring constant, Poisson’s ratio, yield point, break point) and using them to find the right tension for your product and process.
- How is tension created and controlled? Motors, brakes, clutches (including differential winding shafts), load cells, dancer rollers and draw control.
- What is a tension zone? How to identify tension zones in your process? How do additional tension zones allow for process optimization?

- What causes machine direction (MD) tension variations? Sources of web tension losses from roller bearing friction, contact with slipping or non-turning elements (roller, bars, flanges), nip roller drag, process drag (coating, calendaring), boundary air friction (viscous drag), adhesion peel forces, web bending and gravity (both horizontal and vertical).
- What causes transverse direction (TD) tension variations? Bagginess, roller alignment, diameter variations and splicing errors.
- What causes tension transients (variations over time)? Acceleration and inertia (both rollers and winding/unwinding rolls), dancer roller, slack at start up, turret winder indexing, winder roll transfer processes and accumulators.
- What are the options for motors and drives in web handling? How are they tuned? What are the effects of the web, roller, motor-roller drive coupling, and web path in tension control? What devices are used for feedback in closed-loop tension control? Best practices in motor, drives, brakes, clutches, load cells and dancer roller systems will be reviewed.

Lab Demonstrations

Lab #1 – Measuring and Calibrating Load Cell and Dancer Rollers

Learn how the feedback devices of closed-loop tension work and when to trust they are providing accurate tension measurement.

Lab #2 – Measurement of Web System Drag

Learn how to use Spin Down testing to measure tension losses from boundary air friction on web and rollers and from tension losses at the web/roller interface from web bending, roller venting and roller deflection. See how this information is used as inputs to predict static tension levels in web lines.

Lab #3 – Analysis of Dynamic Tensions in Web Lines

Learn how to obtain model inputs from web line components such as motors, drives, rollers and control apparatus. Observe how math modeling is used to predict dynamic tensions in web lines.

Lab #4 – Optimization of Drive Tuning

Learn the basics of establishing drive tuning parameters for current, speed and position loops in web lines. See how current loop proportional and integral tuning is optimized by conducting locked rotor tests. Observe speed loop optimization methods by conducting load set point testing. Perform float arm (dancer) and tension (load cell) step tests to optimize the position loop.

Workshop Instructors

The workshop will be presented by Dr. Kevin A. Cole and Robert L. Walton of Optimization Technology, Inc.

- Dr. Cole, a Senior Web Handling Development Engineer with Optimization Technology Incorporated, has a PhD in Mechanical Engineering from the University of Rochester. Kevin developed his expertise in web handling over his 20+ years working for Eastman Kodak Company and led their internal training program on winding and conveyance process fundamentals. He was also an active participant in the OSU WHRC, including chairing their Industrial Advisory Board for four years. In addition to his many patents, Dr. Cole is a welcomed keynote presenter and published author for various trades journals and web handling conferences.



- Mr. Walton, a Senior Web Handling Development Engineer with Optimization Technology Incorporated, has an MS Systems Science degree from Michigan State University where he majored in the study of theory of feedback control systems. Bob worked from Eastman Kodak for 20+ years where he developed and honed his analysis and synthesis skills on the modeling of dynamic effects within web handling lines. Bob developed and taught courses worldwide on web handling, mathematical modeling, and vibration fundamentals, presented papers at international conferences, and is the author of six patents.

About the Workshop Facility

The Optimization Media Conveyance Facility (MCF) is a 5000 sq. ft. space featuring experimental, analytical, and limited production web handling capabilities for narrow and wide applications. The MCF, acquired in 2008 by OTI, has a 35-year history serving as an internal resource for Eastman Kodak Company, but is now available for commercial use, including serving as host for this workshop.

Workshop Fees:

	Registration Fees	Early Registration Discount (3 weeks advance)
First registration:	\$1449	\$1379
Second registration:	\$1379	\$1313
Third registration:	\$1313	\$1249