Non-Contact, Laser-Based Technology for Accurately Measuring the Length and Speed of Product in Paper Production

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Presentation Overview

- **Intro: Productivity and quality challenges**
- **Non-contact laser measurement technology**
- **Application examples**
- **ROI of measurement accuracy**
- **Conclusion**
- **Questions**

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Introduction

- Global competition is fierce
- Manufacturers are driven to optimize productivity, improve quality, and remain economically competitive
- Problem: length and speed measurement inaccuracies cause costly rework, quality issues, material waste, and product returns

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Need for Accurate Length and Speed

Paper manufacturing segments and applications where length and speed measurement accuracy is critical.

Paper Manufacturing Sector	Critical Application Process Requirements
▪ Paper operations ▪ Packaging ▪ Converting ▪ Laminated paper ▪ Coated paper ▪ Extrusions ▪ Non-wovens	▪ Continuous length ▪ Cut control ▪ Speed control ▪ Stretch/draw control ▪ Product positioning ▪ Quality control ▪ Index and positioning

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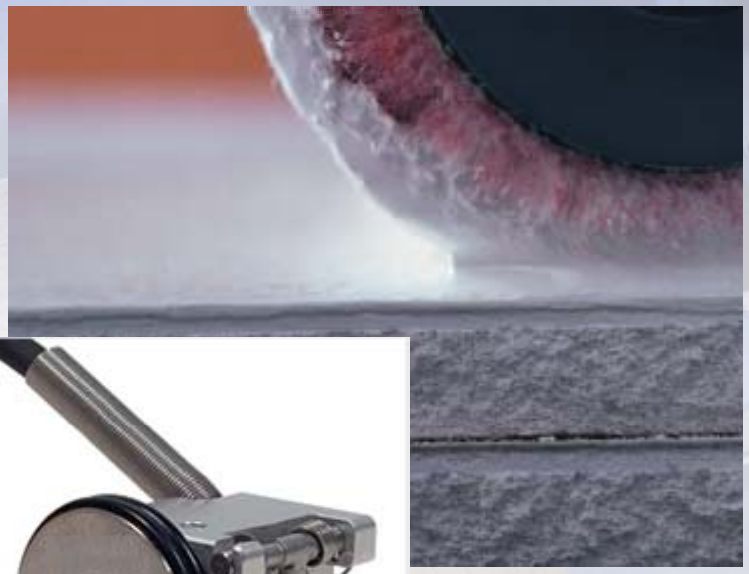
Common Measurement Approaches

- Contact measurement systems:
  - Rotary encoders
  - Wheel tachometers
  - Drive encoders
- Problems:
  - Slippage
  - Day-to-day wear
  - Debris build-up
  - Mark/damage product
  - Calibration and service
- Inaccuracies >1 – 2% or greater



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LaserSpeed Non-Contact Technology

for accurately measuring length and speed

- Non-contact encoder
- Measures product directly
- Uses Laser Doppler Velocimetry (LDV) technology
- Highly accurate, repeatable product length and speed measurements
- Better than .05% accuracy, .02% repeatability
- Permanently calibrated

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How LaserSpeed Works

Laser beam overlap region is where measurements are made. Detects moving product regardless of shape, surface, or color

Non-Contact, Laser Encoder

Laser Beams

Standoff Distance

-Vel

Pass Line

+Vel

Depth of Field

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Laser Doppler Velocimetry (LDV) Theory

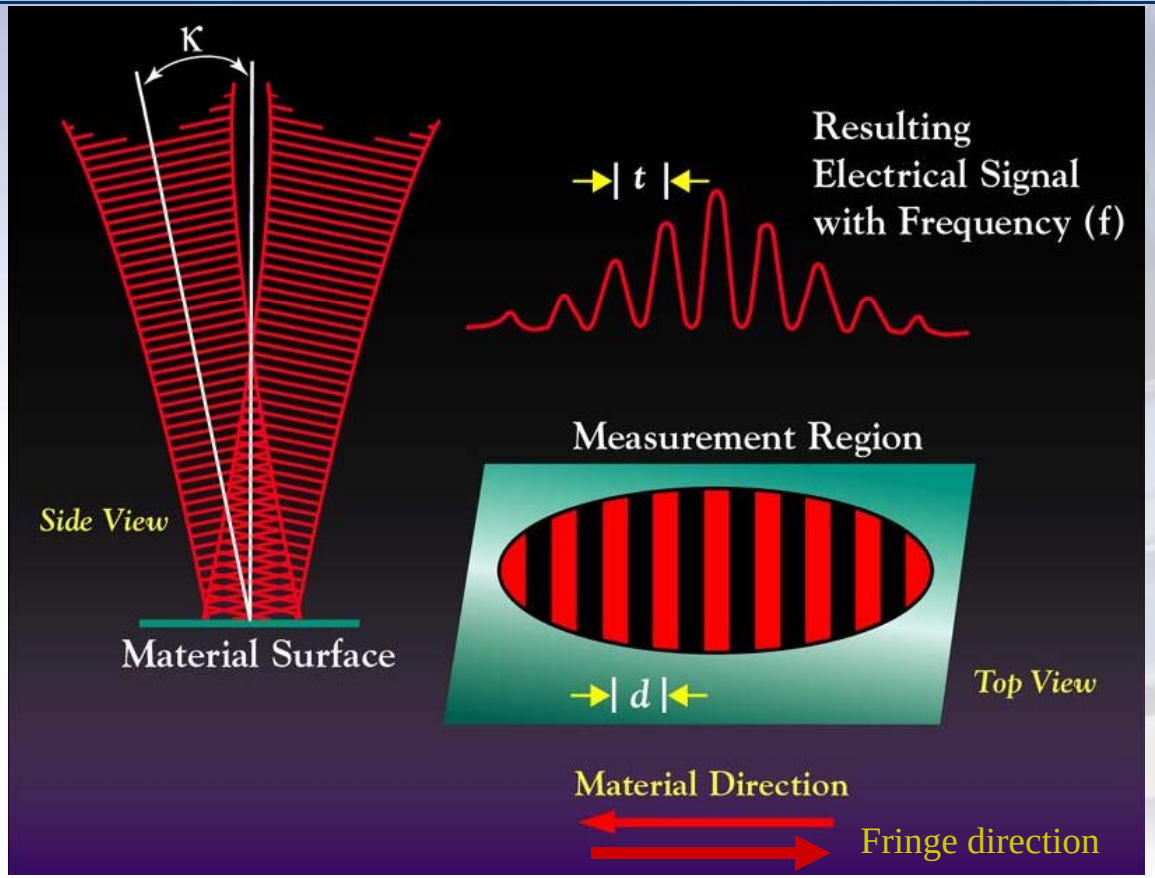
$$d = \frac{\lambda}{2\sin\kappa}$$

$$v = \frac{d}{t}$$

$$t = \frac{1}{f}$$

$$V = d * f$$

$$L = \int_0^T v\,dt$$



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LaserSpeed Measurement Capabilities

- Measure product speeds to 39,000 ft/min (12,000 m/min)
- Stand-off distances to 39.4 in (1000 mm)
- Depth of field to 3.0 in (100 mm)
- Customizable pulse rates to 5 MHz

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Application Examples

- **Profile:** Sanitary paper products manufacturing
- **Problem:** Inaccurate length measurement at slitter/rewinder station due to mechanical encoder errors – slippage, debris build-up
- **Solution:** LaserSpeed encoder provides near .05% length accuracy
- **Results:**
  - Eliminated 2% product give-away
  - Realized $40,000 savings/yr
  - ROI in 3 months

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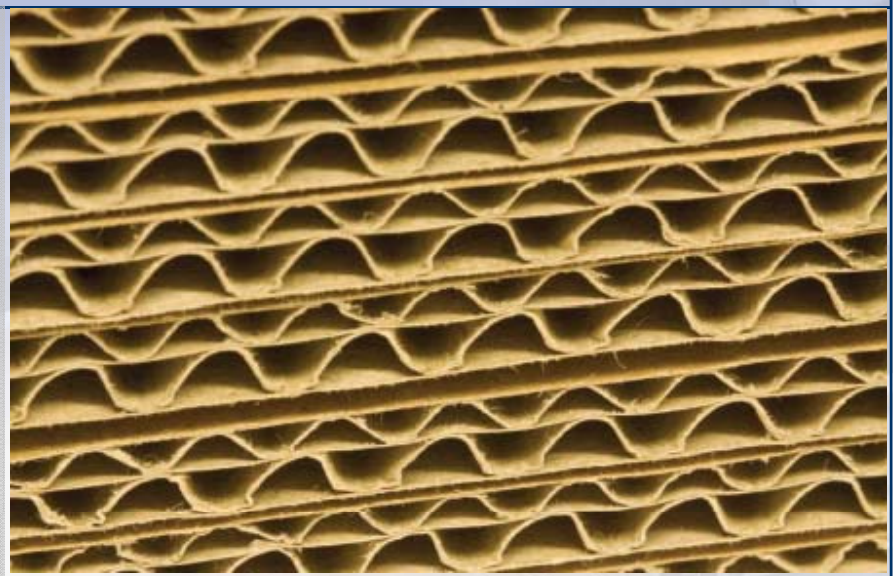
Application Examples

- **Profile:** Packaging production
- **Problem:** Inaccurate cut control due to tachometer slippage, resulting in 90 ft of scrap with each change-over (25 per day)
- **Solution:** LaserSpeed encoder accurately measures product length/speed; provides precise pulse counts to control cutters
- **Results:**
  - No slippage errors
  - Cuts boards to target length during change-over
  - Potential savings of $202K/yr
  - Reduced maintenance costs



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Application Examples

- **Profile:** Business paper manufacturing
- **Problem:** Over-supplying and shorting product by 2.5% due to tachometer slippage; also flying splice problem
- **Solution:** LaserSpeed encoder accurately measures length on rewind and controls tension on unwind
- **Results:**
  - Higher length & speed accuracy
  - Reduced product give-away and scrap
  - Precise control of splicing speeds
  - Decreased downtime

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ROI of Measurement Accuracy

Example

- 355 production days per year
- 22 hours of production a day
- Line rate of 210 ft/min
- Cost to manufacture material is $0.06/ft
- Current encoder accuracy is 1.5%

Total give-away per line per year:

$88,565

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ROI of Measurement Accuracy

Savings are realized by:

- Minimizing product waste
- Reducing product shortages and overages
- Increasing product quality
- Eliminating maintenance
- Minimizing downtime
- Lowering the cost of ownership

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Conclusion

- Important that paper manufacturers look at proven ways to increase productivity, product quality, and bottom-line
- Implementing a highly accurate length and speed measurement system is key
- The LaserSpeed non-contact encoder has been proven on many types of manufacturing processes
- Result is precision length and speed measurements for today's quality-driven manufacturers

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Thank You -- Questions

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