Textile & Composites

Industry Application

Overview

Carbon fiber manufacturing and textile production require sensing systems that can see "Black-on-Black" and handle complex textures. Roll-2-Roll brings **Vision System Capabilities** to the production floor in a rugged, easy-to-use package. Our sensors utilize **spatial awareness** to detect thread counts, gaps, and edges on low-contrast materials without the need for expensive engineering or calibration.

The Engineering Challenge

Detecting dark materials against dark backgrounds is a persistent problem in composites.

- **Carbon Fiber "Black-on-Black":** Detecting the edge of black carbon fiber against a black roller or conveyor belt is incredibly difficult for standard optical sensors due to lack of contrast.
- **Tow Spreading & Gaps:** Individual carbon fiber tows must be spread to form a seamless sheet. Unnoticed gaps reduce structural integrity.
- **High Temperature:** Oxidation ovens operate at high heat, destroying standard electronics inside the process zone.

The Roll-2-Roll Technical Advantage

Our technology sees texture where others see only color, with **versatility** for challenging materials.

- **Contrast Detection:** Dark materials such as carbon fiber absorb infrared light; we set the light angle or use a contrasting backing roller so the edge is detected reliably.
- **Wide Viewing Area:** Allows tracking of wide sheets or multiple tows with a single sensor unit (up to 960mm), eliminating the need to reposition sensors for different widths or use expensive motorized positioners.
- **Line Scan Camera Technology:** High-resolution pixel arrays enable counting of individual threads and precise gap measurement.
- **Environmental Robustness:** Mount at the oven exit within -10 to 65 °C (14 to 149 °F); the controller can sit up to 10 m away.
- **Modularity:** A sensor used for web guiding can be repurposed for thread counting or flag detection, protecting your investment.

Key Applications

1. Thread and String Counting

The sensor functions as a vision system to count individual threads or strings (e.g., for tire cord or elastic waistbands) and measure the gaps between them. This ensures density consistency and detects broken threads immediately.

2. Selvage Measurement

Measures the width of the selvage (the self-finished edge of fabric) to minimize trim waste. High-resolution monitoring allows for tighter control of the textile finishing process.

3. Carpet Manufacturing

Tracks the tufting edge to measure the effective width of the carpet. The **Wide Viewing Area** allows tracking of wide materials without needing to reposition sensors.

4. Process Monitoring

Measures width changes caused by expansion and contraction during dyeing and heating processes. The sensor provides real-time feedback on material dimensional stability under thermal stress.

5. Tow Width & Gap Measurement

A bank of Roll-2-Roll sensors monitors the width of individual tows and detects gaps between them during the spreading process, ensuring uniform sheet formation.

Supported Web Guiding Solutions

Robust guiding for flexible and textured materials.

- **Center Guiding:** Crucial for carpet and wide-textile manufacturing. Ensures the heavy, often variable-width web remains centered for coating or tufting.
- **Edge Guiding:** Standard guiding for selvedge alignment in weaving or finishing lines. Roll-2-Roll sensors handle the "fuzzy" edge of textiles better than air sensors.
- **Unwind Guiding:** Controls the payout of fabric rolls into the process, preventing wrinkles and tension issues from the start.

Technical Comparison

The "Scanner vs. Laser Pointer" Analogy: Comparing an Roll-2-Roll Sensor to a standard photo-eye is like comparing a flatbed scanner to a laser pointer. On a black carbon fiber web, a laser pointer sees nothing—just darkness. The Roll-2-Roll sensor (scanner) images the fiber against a contrasting backing roller or with the light angled for the material, allowing it to "see" the edge reliably, all while being **Plug-and-Play**.

- **Contrast:** Standard sensors fail on Black-on-Black. Roll-2-Roll sets the light angle or uses a contrasting backing roller for reliable detection.
- **Tow Monitoring:** Requires multiple narrow sensors. Roll-2-Roll uses **Wide Array Sensors** (fewer units).
- **Resolution:** Analog sensors can't see threads. Roll-2-Roll offers **Line Scan Precision**.
- **Heat:** Rated for -10 to 65 °C (14 to 149 °F) at the oven exit.