Tire & Rubber

Industry Application

Overview

Building tires involves layering sticky rubber, steel belts, and fabric cords. The defining challenge is contrast: detecting black material on black backgrounds. Roll-2-Roll® Sensors are a **Vision System in a Sensor Package** that relies on **spatial awareness** and texture differentiation rather than color contrast. This allows for robust guiding of tire components where standard photo-eyes fail, with **no calibration required** for material changes.

The Engineering Challenge

Rubber processing presents unique optical and mechanical difficulties.

- **Contrast (Black on Black):** Detecting the edge of black rubber on a black conveyor belt is extremely difficult for standard optical sensors due to the lack of light reflection difference.
- **Width Variation:** Rubber is elastic; its width changes with tension. Monitoring this variation is vital for tire balance and uniformity.
- **Adhesion:** Materials are sticky, making contact sensors impossible to use.

The R2R Technical Advantage

We don't rely on color contrast; we rely on surface texture and **linear optical technology**.

- **Contrast Sensitivity via Spatial Awareness:** The sensor detects the texture difference between the rubber (matte/textured) and the belt (smooth/worn), enabling reliable guiding even with zero color contrast.
- **Wide Dynamic Range:** The sensor can handle the varying reflectivity of rubber compounds without saturation or signal loss.
- **Wide Sensor Range:** With sensor widths up to 960 mm, the system can accommodate various tire component widths without the need to mechanically move the sensor, eliminating expensive positioners.
- **No Programming Needed:** Simple "teach" functions allow operators to reset guide points instantly through the controller interface without writing code.

Key Applications

1. Black-on-Black Measurement

Measuring black rubber against a black background is challenging. These sensors can be installed over a white roller (or with a white background reference) to create a contrast difference, allowing for accurate width measurement of tire plies and treads where other sensors fail.

2. Calendering Uniformity

Monitors the width of the rubber sheet as it is flattened during the calendering process to ensure uniformity. Precise alignment here prevents internal tire defects and structural weaknesses.

3. Tire Building

Ensures the cut rubber sheets have the correct dimensions before they are wrapped around the tire-building drum. This step is crucial for maintaining the balance and safety of the final tire.

4. Inner Liner Width Measurement

Measure the width of the inner liner sheet before cutting. R2R sensors provide continuous feedback on width consistency, ensuring the liner meets tire specifications.

Supported Web Guiding Solutions

High-contrast control for tire components.

- **Center Guiding:** Used for aligning tire cord and tread layers. Maintains the symmetry of the tire construction, which is vital for balance and performance.
- **Edge Guiding:** Guides rubber strips and inner liners into cutters or winders. Our texture-based sensing handles black rubber on black belts where others fail.
- **Master-Slave Guiding:** Synchronizes the position of multiple ply layers during assembly to ensure they are stacked directly on top of one another.

Technical Comparison

The "Scanner vs. Laser Pointer" Analogy: Comparing an R2R Sensor to a standard photo-eye is like comparing a flatbed scanner to a laser pointer. A laser pointer sees black rubber and a black belt as identical—darkness. An R2R sensor (scanner) sees the entire "picture" of the web's texture (the grain of the rubber vs. the weave of the belt), allowing it to find the edge where others see nothing, all while remaining as easy to use as a standard office appliance.

- **Contrast:** Fails with Black-on-Black. R2R uses **Texture Discrimination**.
- **Material:** Sticky rubber fouls contact sensors. R2R is **100% Non-Contact**.
- **Width:** Difficult to measure elastics. R2R provides **Real-Time Width Data**.
- **Simplicity:** No complex vision setup. R2R is **Plug-and-Play**.