

Press Release

Date: January 2021
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Reference number: PR-0001-CPE-250121-LSV

Non-contact length measurement of large-diameter cables and wire ropes

With the advancement of technical possibilities and increase in global competitive pressure, it is essential that manufacturing processes in the cable and wire industry remain efficient. Highly accurate, reliable length measurements are extremely important when cutting the finished product to length.

This may seem obvious ... but the devil is often in the details. Both contact-based sensors and conventional non-contact systems are somewhat limited when it comes to measuring large-diameter stranded cables and wire ropes. The strengths of the non-contact ProSpeed® LSV-2100 Laser Surface Velocimeter from Polytec (Fig. 1) come to the fore where other sensors fall short of the mark.

Contact-based measuring systems, such as measuring wheels, always require adequate contact with the surface of the object material to ensure that the entire length of the product is measured. Inadequate contact causes slippages, resulting in significant inaccuracies during the length measurement process. The contact pressure can be increased to improve traction but this measure increases wear, tear and the cost of maintaining the contact-based measuring sensors.

For many years, non-contact length and velocity measurement based on the laser Doppler principle has been the established solution to resolving such problems (see technology box). Since this measuring method does not require any contact with the object material, it is impervious to slip and mechanical wear. However, even conventional non-contact sensors are often unsuitable for correctly measuring the length of large-diameter stranded cables and wire ropes, due to the surface structure of the cables.

A laser Doppler length-measuring instrument sees every product surface as a peak and valley landscape. On smooth surfaces, the peaks and valleys are microscopic and therefore do not pose a problem. If the height differences are greater, an important technical feature of the measuring instrument comes into play: the depth of field (see technology box). This depth is a measure of how much the distance between the measuring instrument and the product surface can vary while a reliable measurement signal can still be maintained. This is most important when cables and wires are not guided properly or the product surface is extremely uneven. It is common for conventional non-contact sensors used in the cable and wire industry to have a measuring field depth of a few millimeters to a few centimeters – which is not enough for the large differences in height in stranded power cables or thick wire ropes, for example (Fig. 2).

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This is where the strengths of the ProSpeed® LSV-2100 from Polytec come to the fore. With a minimum depth of field of 120 mm, it is more than capable of reliably measuring the length of unguided, bouncing products or products with extremely uneven surface structures.

Not only does the ProSpeed® meet the most demanding metrological requirements; it also boasts a comprehensive interface concept that allows flexible integration into any process environment. For traditional process integration, an encoder output and a selection of digital inputs and outputs ensure maximum reliability and reaction speed. Ethernet, a serial interface and various fieldbus protocols ensure maximum flexibility when the instrument is integrated into modern process control systems. Parameters can be conveniently configured from any mobile device via a fully wireless web interface and without requiring additional software.

Technology box: Laser Doppler velocimetry

The ProSpeed® works according to the "differential Doppler technique". Here, two laser beams – which are each incident to the optical axis at an angle φ – are superimposed on the surface of the sample (Fig. 3). The area with an adequate overlap is called the depth of field. Here, the beams generate an interference pattern of light and dark fringes. The fringe spacing Δs is a system constant that depends on the laser wavelength λ and the angle between the laser beams 2φ . The following applies: $\Delta s = \lambda / (2 \sin \varphi)$.

If a particle moves through the fringe pattern, the intensity of the light it scatters back is modulated. As a result, a photodetector in the sensor head generates an AC signal, whose frequency f_D is directly proportional to the velocity component of the surface in the measurement direction v_p and the following applies: $f_D = v_p / \Delta s = (2v_p / \lambda) \sin \varphi$ (where f_D is the Doppler frequency, v_p the velocity component in the measurement direction and Δs the fringe spacing in the measurement volume). The value $\lambda / \sin \varphi$ makes up the material measure for the velocity and length measurement. It is precisely measured for every sensor and printed on the identification label.

In the text box: About Polytec

Being an innovative high-tech firm, Polytec has been developing, producing and selling measuring technology solutions for research and industry for more than 50 years. Building on its success in the distribution business, in the 1970s Polytec began developing and producing its own laser-based measuring instruments. Nowadays, the company – which has its headquarters in Waldbronn near Karlsruhe – is a world leader in the field of optical vibration measurement with laser vibrometers. The current wide range of innovative company in-house products also includes velocity and length sensor systems, surface metrology solutions, analytical measuring technology and factory automation concepts. Another of Polytec's core skills lies in distributing high-tech products from other manufacturers.

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Figure 1: ProSpeed® LSV-2100 length and velocity sensor



Figure 2: This copyright notice must be included: ©iStock.com/Clandy-Images
Stranded cables and thick wire ropes push conventional length measuring systems to their limits

(DEPTH OF FIELD)

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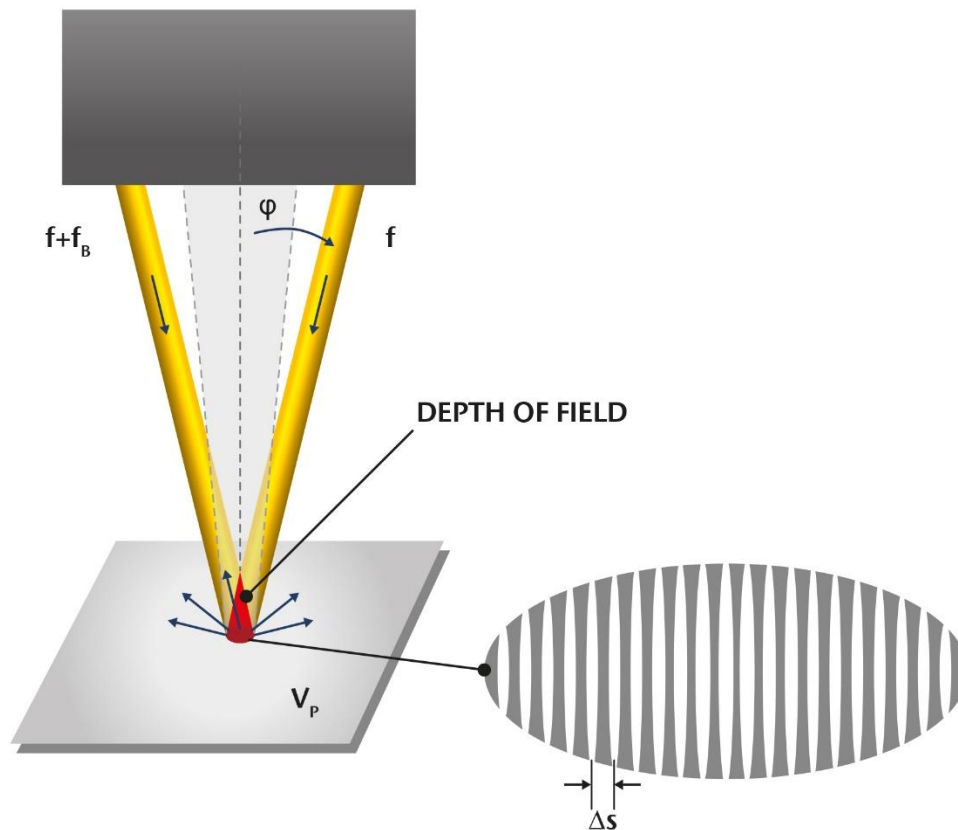


Figure 3: Laser Doppler Velocimetry: the operating principle

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