Reason for production stoppages exposed at rolling mill

High-speed camera from Optronis makes the source of problem visible

Badische Stahlwerke (BSW), which is based in Kehl in Germany, supplies customers throughout Europe with premium grade bar steel and wire rod. It's one of the leading electric steel producers in the world, forming a corporate group with twelve specialty subsidiaries. BSW's steel plant is where the heart of the company's steel production beats. In just four hours, scrap metal is processed into steel products and laid out ready for shipping. BSW's rolling mill fabricates semi-finished steel products - prefabricated steel raw material moldings with a square cross-section known as billets - which are worked into bar steel and wire rod finished products. This process takes place at production speeds of up to 360 km/h. The bar steel is then set into concrete as reinforcement for building construction, while the wire rod is processed by BSW customers into reinforcement products such as welded wire mesh, lattice beams, reinforcing wire and reinforcing rod spacers. The end users for these products are likewise in the construction industry.

However, BSW's rolling mill was experiencing repeated stoppages in production due to a recurrent problem with the deflection of stock involving one of the shear systems for hot stock. Normally, the shears cut the continuous strand by pressing its two blades into the hot strand with a rotary motion; the cut-off piece is then carried along by a set forward motion and deflected below. But in this case the stock was repeatedly deflected the wrong way. Instead of gliding smoothly into the channels provided, the rolling stock would often become stuck between channels, resulting in constant stoppages in production. It was only when the stock had been removed manually that production could start up again. Pinpointing the source of the problem with the naked eye was impossible, as at this point the rolled product is moving at a speed of 42 feet per second!

Easy to operate – the CR 600

It was down to Optronis' high-speed CamRecord 600 camera to expose the source of the problem. With a high spatial resolution of 1280 x 1024 pixels, the camera can capture images at a rate of 500 frames per second. Compare this with the human eye, which has a response time of around 42 milliseconds and can therefore only perceive 24 images per second. The other advantages offered by the CamRecord 600 are down to its ease of handling. After just a short introduction by Optronis, an operator at the rolling mill was able to set up the camera with a standard lens and tripod and operate it using a standard laptop and the relevant software for the camera via a FireWire interface, thus eliminating the need for expensive interfaces and frame grabbers on the PC. Another advantage of the CR 600 is its large built-in image memory, which captures the data during recording and forwards it to the PC via the FireWire interface or a gigabit Ethernet (GigE) interface for replay in slow motion.

The high-speed camera from Optronis pinpointed the source of the problem as the CR 600 allowed BSW staff to trace production runs with absolute precision on the screen. As soon as a fault was spotted in the sequence, they pressed the

trigger (i.e. the shutter release). This was set to ensure that the section of the sequence visible before the trigger signal would always be saved so as to factor in the slower response time of the human eye as a general principle. This allowed the entire cutting procedure to be recorded and saved.

The shots needed for the investigation were therefore reduced to a minimum. The fact that the camera is easy to manage meant that the process could be filmed both with the run of the stock and vertically. It didn't take long for the source of the problem to become clear: the shear's deflection process wasn't set precisely enough. This knowledge helped BSW to optimize its production sequence and thus eliminate production stoppages and the incidence of rejects.

CamRecord CR600x2

Specifications

Resolution	1280 x 1024 pixel
Frame Rate @ Max. Resolution	500 fps
Image Sensor	Progressive Scan CMOS
Exposure Time	1 µs - 1/Framerate
Active Area	17,92 mm x 14,34 mm
Sensor Diagonal Dimension	22,95 mm
Pixel Size	14 µm x 14 µm
A/D Conversion	10 Bit or 8 Bit
Dynamic	60 dB (90 dB optical)
Sensitivity	25 V/lux*s
Shutter	global electronic, >1 µs exposure time
Trigger Signal	TTL, switch, open collector, rising or falling edge, on image content variation
Synchronization	internal, external
Interface	Gigabit Ethernet
Video Output	VGA
Power	12 VDC / 12 W
Lens Mount	Nikon F-Mount (optional C-Mount)

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