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Devices

Advantages

Testing

Principle

Optical Image Correlating Velocimeter for metallurgical plants

Optical Image Correlating Velocimeter (ICV) was developed to measure speed and length of product in metallurgical process. The ICV represents alternative solution to laser doppler based instruments achieving similar accuracy on good quality surfaces and superior accuracy on rough and poor quality surfaces. For detailed description of principle of operation refer to paper [1]. The production model of the ICV is shown in Fig.1.



Fig.1. Image Correlating Velocimeter

Basic Characteristic of the ICV

- No contact measurement of speed , length, and distance to the product
- Small size and weight
- Wide range of stand-off distance
- Measure distance to object
- Works well from very slow to medium range of product velocity
- Instantaneous measurement of speed and displacement of the product
- Wide operating temperature range
- Quick and easy installation and service

Speed and length measurement of slab in continuous casting process using ICV

The ICV has been installed on quad continuous caster machine, connected to MNLZ process control system, and operated flawlessly over 9 month period. Figure 2 shows installation diagram and four ICVs monitoring quad caster machine. The point of installation was close to the slab cutting machine. Figure 3 shows photograph of two ICVs monitoring first and second slab on the quad caster. ICV at the bottom is pointed at the first slab, which is 1800mm away, while upper instrument monitors the second slab 3700 mm away. At this distance both ICVs operated without need for cooling. All four ICVs were connected to process control and monitor computer, which processed and recorded data. Data from the ICV can be also used to control operation of slab

cutting machine. Important feature of ICV is instantaneous reading of slab velocity and possibility to detect fast and sudden changes in slab speed caused by instability in the crystallizer. Test results of pilot installation and operation of the ICV were published in papers[3] and [4].

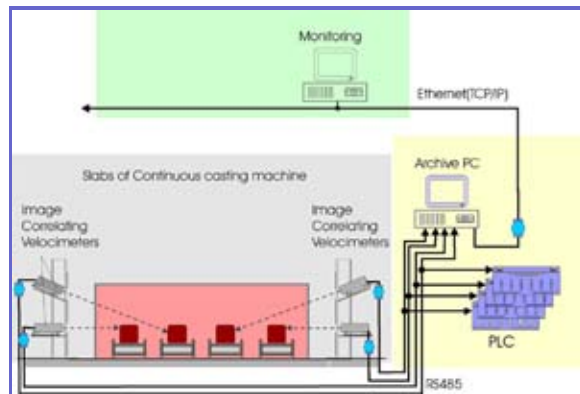


Fig.2. Installation diagram of four ICVs on quad casting machine



Fig3. ICVs monitoring slab 1 and 2



Fig.4. Computer rack

Definition of measurements and data format

- Instantaneous velocity: slab movement speed in mm/sec
- Length: slab length in mm measured from the moment of entering the ICV field of view or from the moment of starting new measurement
- Distance: distance in mm from the reference point on the ICV to the slab surface

Technical specification of process control system MNLZ for continuous caster machine

- Slab temperature: 450...1100°C
- Slab velocity: -5...+5 m/min
- Velocity measurement accuracy: 1 %
- Length measurement accuracy: 0.15 %
- Stand-off distance: 1600...4000 mm
- Depth of field: 600 mm
- Distance measurement accuracy: 0.2 %
- Output data rate: 8...16 Hz
- Digital data interface : RS485
- Operating ambient temperature range: -10...+60°C
- Enclosure environmental rating : IP-54
- External cooling: N/A

- Supply voltage: 220 VAC or 24 VDC

ICV controlling billet cutting machine

Figure 5 show ICV installed 2100 mm from the billet surface and controlling cutting machine.



Fig.5 ICV controlling billet cutting machine

Technical specification of billet cutting system

- Billet temperature range: 450...1100°C
- Billet velocity range: -4...+4 m/sec
- Velocity measurement accuracy: 1 %
- Length measurement accuracy: 0.15 %
- Stand-off distance: 2000...2600 mm
- Depth of field: 600 mm
- Output data rate: 100 Hz
- Digital data output: RS-485

Installation requirements and operational limits:

For accurate operation measured object must fill ICV's field of view, which at 2 m distance is 20 mm high and 250 mm wide. At 4 m distance field of view is 40 mm high and 500 mm wide.

ICV operates properly over product temperature range of 1100°C to 450°C. Measuring to cooler products requires additional illumination. Two 100W bulbs placed at 2 m to 2.5 m distance from the product surface provide sufficient illumination.

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