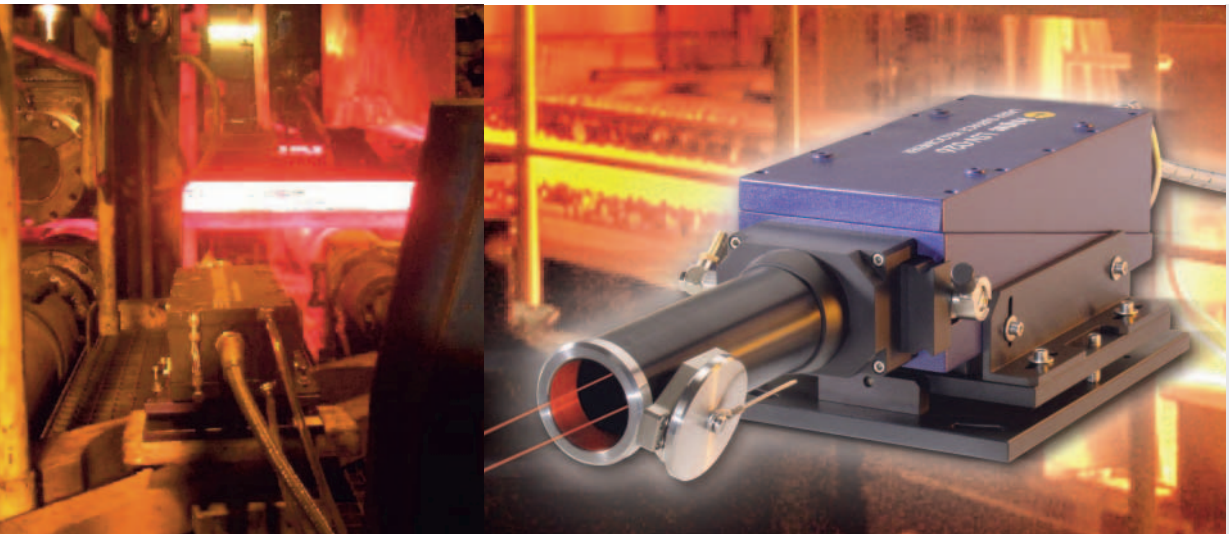
Polytec

Casting Speed of Hot Steel



Field of Application

- VIB
  Vibration Measurement by Laser Doppler Vibrometry
- **LSV**
  Speed and Length Measurement by Laser Surface Velocimetry
- TOP
  Surface Topography Measurements by White-light Interferometry

Motion Measurement at a Thin Slab Steel Mill using Laser Surface Velocimetry

Measure while the iron is still hot! This expression describes the problem addressed by the steel industry to measure precise length and velocity data from red-hot objects for regulating and controlling production processes. Non-contact measurement techniques are particularly suitable for acquiring this data.

Explanation of specialist terminology

Slab [metallurgical works technology]: molten metal is poured into an ingot mold in the steel works (preliminary product) with a rectangular cross-section to manufacture steel sheets and bands in the mill.

Ingot mold: a mold made of cast iron or high temperature alloyed steels used in various molding processes (foundry).

The aim of the measurement presented here was to determine without any contact the length and transport velocity (= casting speed of the slab poured) of a hot strand, which needs to be cut. This data was then used to cross-check with the corresponding data that the steel mill itself makes available. In the thin slab steel mill, a strand of liquid steel is continuously poured into an ingot mold, which is then passed through a system of driven and freely rotating rollers. To ensure even material transport, the ingot mold periodically makes a lifting movement with a frequency of 5.1 Hz and several cm stroke.

Measurement task

In June 2002, a trial to attain a high-precision laser measurement of the slab-length and slab-speed was carried out in the Thyssen Krupp Stahl AG thin slab mill by the engineering firm Alfred Rachner in cooperation with Polytec GmbH. Using slab cutters, the continuous strand is cut into parts of a defined length.

To control the cutting process, it is necessary to have precise information on the length of the slab to be processed. The mill itself measures the length of the slab using encoder wheels. However, the encoder wheels often get contaminated, which results in falsified data and makes it necessary to carry out a maintenance inspection.

Polytec GmbH
Optical Measurement Systems
Application Note
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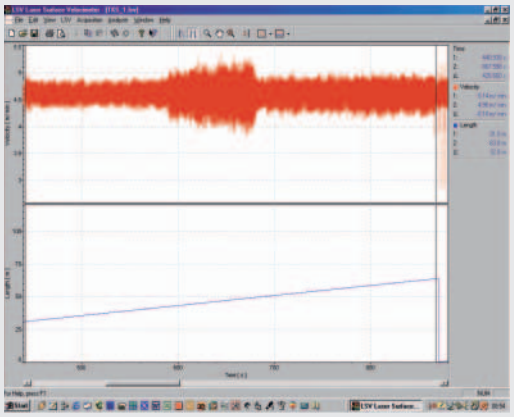

Fig. 1: Speed and displacement signal from a slab

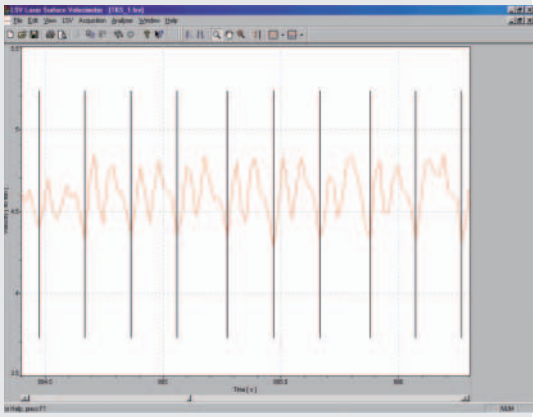

Fig. 2: Ingot mold lift oscillation on the velocity signal

The laser velocimeter measurement system was set up between two drives before the slab cutters. It was made up of a Polytec LSV-026 sensor head with a cooling element, the Polytec LSV Controller and PC system to control and evaluate data.

Results

Fig. 1 shows the results of a speed and length measurement on a slab. You can see the slab speed in the top section of the graphics and the length as a function of time in the bottom section.

The vibrations measurements of the velocity signal can be clearly attributed to the ingot mold lift (Fig. 2).

However, there was a surprising vibration increase in the middle of the slab to be cut. The cause of this increase was attributed to a mold adjuster used to correct the width of the slab. These oscillations are transmitted through the whole strand and can be identified at points much later. In measurements made on subsequent slabs with differing slab lengths, the increase in vibration was always identified in the middle part of the slab.

The slab speed was clearly determined. Here there were hardly any differences from the slab speed calculated by the mill.

However, the actual slab length measurements showed significant differences between the value from the mill and the results of the laser velocimeter. The deviations identified were in a range of 100 mm – 150 mm and sometimes even exceeded 300 mm difference. It must be assumed that the ingot mold lift falsifies the existing measurement made by the plant as the slabs are accelerated and slowed down by the directional drive (Slippage).

Summary

A non-contact laser measurement system was successfully demonstrated for making slab length measurements independent of movement that were more reliable than the data the thin slab steel mill itself provides.

For more information about Polytec Laser Surface Velocimeters please contact your local Polytec sales/application engineer or visit our web pages **www.velocimeter.us** and **www.velocimeter.co.uk**

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