Non-contact inline dimension measurement

The ability to measure bar or section dimensions during hot rolling provides steel producers with valuable information which can be acted on to improve rolled product accuracy and minimise rejects and rework. The Zumbach STEELMASTER system uses laser scanning technology to measure product shape. It has now been installed in more than 350 units worldwide.

Author: Bruno Mühlheim
Zumbach

Figure 1 illustrates some of the range of shapes produced in rod, bar and small section mills, together with the key dimensions required to meet the required product specifications. Measurement of these dimensions during rolling enables the process to be better controlled and the achievement of tighter tolerances. However, rolling processes are imperfect, and a range of dimensional errors may be introduced, as illustrated in Figures 2 and 3, hence the ability to measure these ‘error’ dimensions is also of great interest to producers, so that product quality is improved and scrap or rework minimised.

Fig 1 Measured shapes and dimensions

Fig 2 Shape deviations (radial faults)

Fig 3 Longitudinal faults
operator with self-explanatory displays and key data. The process transparency is dramatically improved, especially if multiple measuring heads are installed.

MEASURING UNITS
The choice of system depends on what a manufacturer wants to measure and with what precision. SMS is the cheapest solution. SMR the most expensive, but also offers the best performance. SMO offers an intermediate solution and can be sufficient for many requirements.

SMR Rotating Gauges
- For round and non-round products
- Significantly increased measuring rate per second
- Captures at least three profiles in less than 1 second
- Computes cross-section (area)
- High reliability thanks to the fully contactless transmission of power and signals
- Slim design.

SMO Oscillating Gauges (see Figure 4)
- For rounds, squares, hexagons, flats, rebar
- Up to six measuring axes
- Seamless 360° coverage
- No blind zones
- Measurement independent of twist
- Computes also cross-section
- Oscillating or static operation.

SMS Static Gauges
- Especially suited for round products
- Up to six fixed axes
- No moving parts
- Extremely compact
- Practically no maintenance
- Extremely fast measuring rate, short measuring distances
- Most economic version.

Advantages
STEELMASTER gauges offer decisive advantages for easy integration, dependable operation and the data processing and display:
- Hi-Tech laser scanners with top accuracy
- Up to 12,000 measurements / s (2,000 per scanner)
- Distributed intelligence
- One single (fibre optic) cable between local and central processing units
- Compact industrial PC with highest working reliability
- Highly developed STEELMASTER software
- Sophisticated mechanics and protection system
- Close to zero maintenance.
System architecture  This is illustrated in Figure 5. The STEELMASTER systems offer highly flexible and application specific configurations and allow for optimum configuration and layout of the measuring unit(s), processor, auxiliary, devices, networks and peripherals for each rolling mill, and are based on cutting edge technology. The hardware architecture and the software have been conceived for operation under the severe conditions of the steel industry.

THE STEELMASTER SOFTWARE

STEELMASTER is both the overall system name and the user interface. A number of sub-modules (partial options) structure the many functions and tasks and make flexible expansion and upgrades possible. The operating system is based on ‘Windows embedded’, which guarantees a stable operation in industrial environments.

The essential modules are:

- STEELGAUGE for configuration of measuring unit interface with the ODAC laser heads, temperatures, shrink values, etc
- STEELDEFINER (for internal or external installation) for establishing product recipes, product table, product administration, etc
- STEELDATA for filtering and processing of measurement values for configurations, parameter definition, statistics, printout, host protocol, etc
- STEELDATABASE (for external installation) for storage of measurement values in a Maria DB server on the hard disk
- STEELDBVIEWER (SDB Viewer) for recalling and reviewing measurement data and section screens according to selectable search criteria
- STEELMASTER REMOTE which offers communication with up to 10 work stations (PCs) over the ETHERNET for independent tasks, such as recipe preparation, statistics, remote display, etc
- STEELHOST Protocol – Standard communication protocol for downloading of nominal values and set points and for retrieval of measurement data statistics etc. MS

Bruno Mühlheim is with Zumbach, Orpund, Switzerland

CONTACT: bmuehlheim@zumbach.ch