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Wire Rolling Mills

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Profile wire measurement in process

With statistics module, data export and frequency analysis

Until recently, measuring systems used to measure the quality of products inline during the process were used almost exclusively for process control. Process variables were measured, compared with target values and the settings of the production plant were optimized with the deviations determined.

But in times of BIG DATA and Industry 4.0 this often is no longer sufficient. The quality of the production processes should not only be regulated, but also analysed and documented.

As a manufacturer of wire profile rolling mills, FUHR is confronted with constantly increasing demands on geometric precision. Accuracies of class 6 according to ISO 386 are nearly standard. This means a permissible deviation of +/- 0.0030 mm for small profile wires up to 3 mm nominal diameter. If a process capability (C_p or C_{pk}) is required additionally, a window of only +/- 0.0015 mm remains in production.

In order to ensure that these requirements are met in daily production, the wire must be continuously measured whilst exiting the rolling machine, and the roll positions must be corrected fully automatically. In multi-stage rolling processes it is necessary to measure and calibrate already after the pre-rolling stages. Therefore, modern high-speed rolling mills made by FUHR are equipped with several measuring systems.

Conventional laser shadow measurement systems, as typically used in the drawing of round wires, have not proven to be successful in profiling lines. On the one hand, even a slight tilting of the wire changes the size of the shadow. On the other hand, laser systems cannot be used permanently in the wet area of the pre-rolling stages.

FUHR therefore relies on tactile measuring systems in which the wire is scanned with diamond-studded, high-resolution displacement measuring systems. Alternatively, instead of diamond styli, stylus rollers especially adapted to the wire geometry are available.

Fig. 1: Tactile measuring device

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These measuring systems have been developed and built by FUHR for several years. They are characterised by precision, robustness and a particularly good price-performance ratio. As a result, it is now possible and common practice to integrate more than just one of these systems into a rolling mill. FUHR uses these systems in new machines, but also supplies them for existing and third-party plants.

In order to be able to fulfil the customer requirements for data analysis and quality documentation mentioned at the beginning of this article, FUHR has now brought its data acquisition and evaluation system F-MAS to market maturity. It is available as an additional option to the tactile measuring systems but can also be retrofitted to existing digital or analogue measuring systems. During development, special attention was paid to compatibility with third-party systems - especially with regard to retrofitting in existing systems.

With F-MAS, two wire dimensions (e.g. width and thickness of a rectangular profile) are measured with a measuring frequency of 250 Hz. This real data is displayed in diagrams, statistical values are calculated, and frequency distributions are displayed. Reports are generated and raw data are exported. Integration into customer networks is a matter of course. Data export to standard data analysis software is possible via OPC-UA interface.

Also integrated is an FFT analysis, which detects cyclical dimensional fluctuations. Thus, for example, the concentricity error of a roller or the defect of a bearing or gearbox is reliably unmasked as the cause of a quality problem based on the frequency of occurrence of the error.

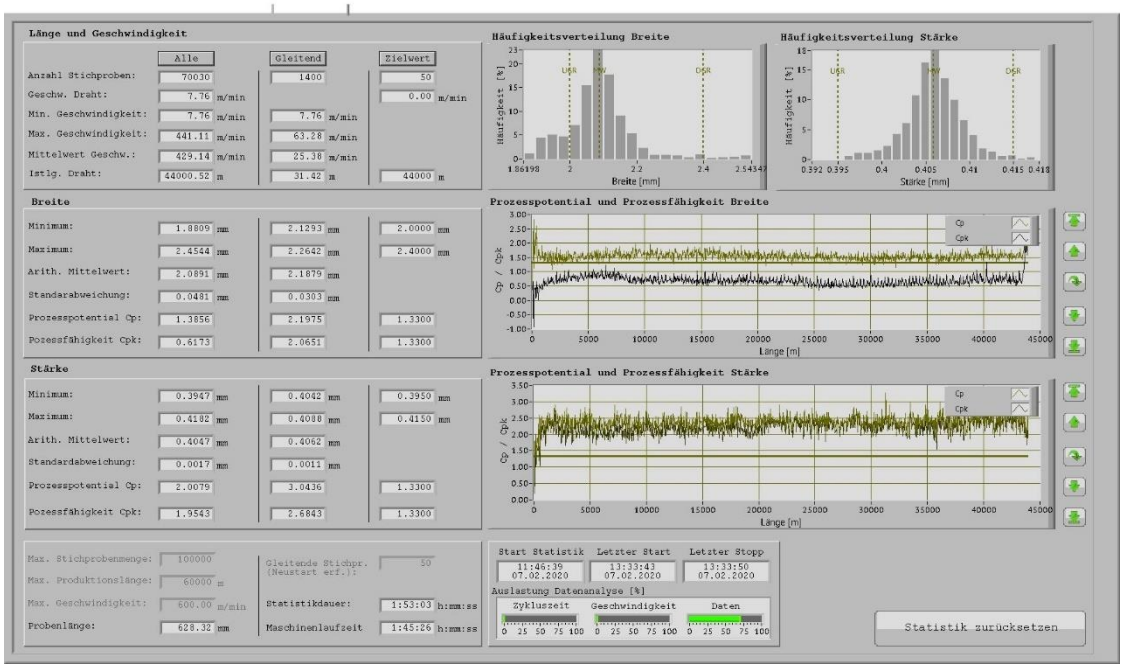

Fig. 2: Evaluation of measuring data via F-MAS