On line Surface Automated Inspection and Quality Control

The Surfin´ system is an automated surface inspection system created to carry out 100% quality control in hot (1000º C) continuous line processes but also in cold ones and allows to detect surface defects such as cracks, folds, scratch marks, holes, roll marks, etc.

www.tecnalia.com
GENERAL FEATURES

- **Inspection portico.** This structure is placed in the line and is composed of three cameras at 120 degrees for the complete inspection of the part (could be more if necessary), illumination and feed/supply sources. This structure has been redesigned based on knowledge acquired in earlier projects and customer suggestions.

- **Connection box houses**, necessary auxiliary electronics (relays, etc.) and the GigaEthernet output converters of the fiber optic communications of the system - Optical fiber shall be used for data transfer from the inspection portico to the main computer, avoiding any noise problem. The cameras employed shall include a series of digital inputs and outputs (for alarms, light signals, etc.) which provides an advantage in that they can also be transmitted by fiber optics to the computer along with the images.

- **Cooling system.** Taking into account that the cameras shall be placed near the red-hot steel parts, it is necessary to keep the temperatures of the different elements in their usual functioning range (< 40ºC).

- **Control Computer.** Located remotely in a control room. Should be connected to an uninterrupted power system (UPS). A connection box converts the fiber to GigaEthernet.

- **Software.** In order to carry out the control, the system shall capture images during the passing of the bar, performing a pre-processing to identify problematic areas. The bar images shall be stored in the disk. A posterior intelligent processing based on SVM algorithms, in the time that is available between bars, shall establish whether these possible defects are truly so, and when positive, shall establish the type of defect and its position. This intelligent processing is based on an interactive training that shall take place remotely from previously stored images. This progressive training shall allow to gradually increase the efficacy of the system.

The system is informed on the bar speed and the associated production data (production data shall be received in the change of batch in the rolling mill). The system must be capable of independently detecting the arrival of a bar with the support of the speed signal and one infrared sensor. As the bar passes, images are captured of the entire surface and a pre-processing takes place (by each camera) that establishes the areas deemed as potentially defective.

Once the bar has completely passed by, its three images are stored along with the potentially defective areas and other data of interest.
PROBLEM DESCRIPTION

• The metallurgy industry uses difficult and complex industrial processes.
• Specially, hot rolling usually generates specific defects (roll marks, etc.) which are repetitive in nature and indicate maintenance problems in the rolling mill.
• Large amounts of worthless defective material could be produced if the process is not inspected correctly.
• Surface defect inspection of steel and other metals
• Flat or complex geometries like tubes or profiles. Hot (400 – 1200º C) or cold options.

Real defect images captured in the line

SYSTEM HIGHLIGHTS

• This system is 50% more efficient than comparable inspection systems
• Market presence and successful implementation in important enterprises throughout Southern Europe.
• Rapid return on investment, far sooner than the average return for automated quality control systems. An example: A customer saves 70 MT of processed steel, thus saving scrap waste every time a repetitive mistake is detected.
• Patented system.

CUSTOMER’S OPINION

“A very decided R & D effort both by TECNALIA as well as by Tubos Reunidos has led to a system which has become a useful tool in the Rolling Mill controls, having been able to detect production problems at early stages in the hot process production.”

Carlos San Martín Goikoetxea, Engineering Manager at Tubos Reunidos
TECHNICAL DATA

GENERAL FEATURES:
• High speed high resolution linear image capture.
• Illumination adapted to application (Hot 1000º C, cold…).
• Defects detected (Cracks, roll marks…) from 0.3 mm.
• Artificial Intelligence based defect learning system.
• Adaptable and re-designable to existing lines.

INTERFACES:
• “Made to measure” Graphical user interface.
• PC based processing.
• Optical image transfer: electrical isolation between image acquisition and processing modules: robustness.
• Ethernet interface 10/100 with optical fiber for communications with line control and other systems.

SOFTWARE FEATURES:
• Windows 7® compatible.
• Remote client: interface the application, training the system… can be performed remotely.

MISCELLANEOUS:
• Hardware / Software customisation upon request.
Additional Information requires the signing of a Non Disclosure Agreement (NDA).