SYSFO
SYSTEMFORSCHUNG M.KÄMMERER

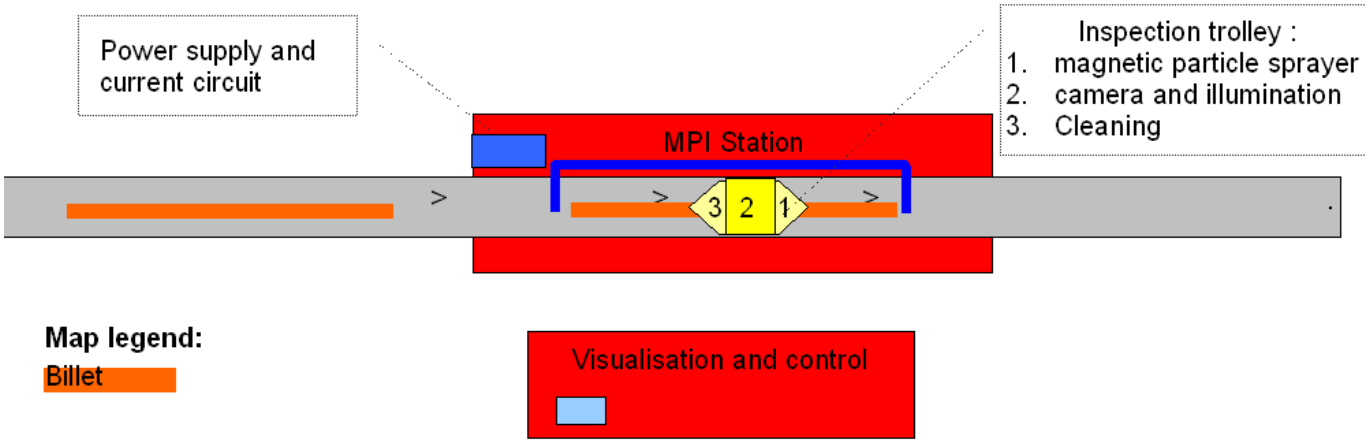
WE INTEGRATE INNOVATIVE SOFTWARE TECHNOLOGIES AND
METHODS OF MACHINE INTELLIGENCE INTO YOUR PRODUCTION

COMPUTER-VISION SYSTEM FOR BILLET SURFACE CRACK INSPECTION – MAGNETIC PARTICLE TESTING

FULLY AUTOMATIC 100% SURFACE INSPECTION WITH FLUX CHECK

Systemforschung a specialist in the field of optical pattern recognition has developed an all in one crack detection system for billets including automatic powder entry, automatic image acquisition, illumination, innovative pattern algorithms, good/bad classification, system monitoring, documentation. It can be integrated inline into a roller way

The billets are stopped on the roller-way. Two contact arms catch it at both ends and lift it 500mm above the roller-way. It is magnetized by a longitudinal current and a trolley moves along the billet, including magnetic particle sprayer, camera and illumination set for inspection of all 4 sides and a bleeding unit for cleaning. Demagnetization occurs during lowering the billet again to the roller-way. Then the next billet moves to the test position while the trolley moves back.



Inspection cycle (ca. 30s for 10m billet length)

1. Transport billets on rollerway ahead and move trolley back (12s)
2. Lift billet 500 mm with contacts (3s)
3. Inspection cycle with 1,5 m/s to right (10s)
4. Lower billet and demagnetisation (4s)

The image processing is done during camera motion. The inspection criteria can be parametrised in accordance with customer‘s requirements. The process monitored evaluation ensures consistent reproducible inspection quality and is fully documented.

The recognition software of the PC based inspection system identifies and measures all kinds of linear displays which are in contrast to the environmental background by shape and intensity.

To do this the software evaluates both the intensity and the geometrical shape of the displays.

The algorithms recognize cracks regardless of direction, curvature and branching and eliminates pseudo errors (artefacts)

- Cracks with intermittent displays are classified as being continuous.
- Local irregularities of the magnetizing and powder entry are automatically recognized and compensated.
- Each display will be classified and measured with respect to length, width, intensity, direction position and contour.
- The inspection does not need a darkened test chamber.

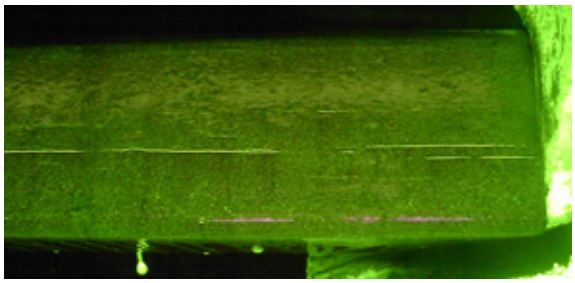
Industrial image processing is superior to manual inspection because of the low system break down rate, real time inspection and because of health benefits for the company personnel. For this reason a growing number of companies are using Computer-Vision Systems.

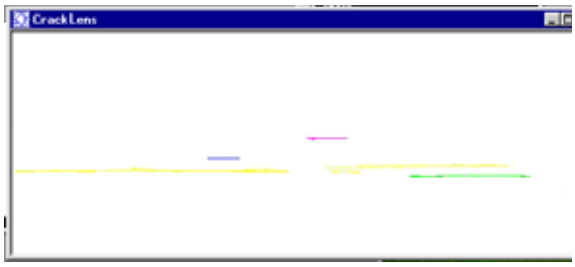
SOLUTION DETAILS

AUTOMATIC BILLET SURFACE INSPECTION

By using innovative image processing methods longitudinal, diagonal and edge cracks on the surface of billets are reliable detected and documented thus being the basis for a computer controlled

optimization system and a manual or fully automatic elimination of surface faults. Longitudinal cracks with a depth between 0,2mm and 0,35mm and a length of ≥ 5mm are detected at a rate of 100%.





Ultra short flashes enable stung sharp images during the real time operation of the whole system. Vibrations and background light don‘t influence the imaging process.

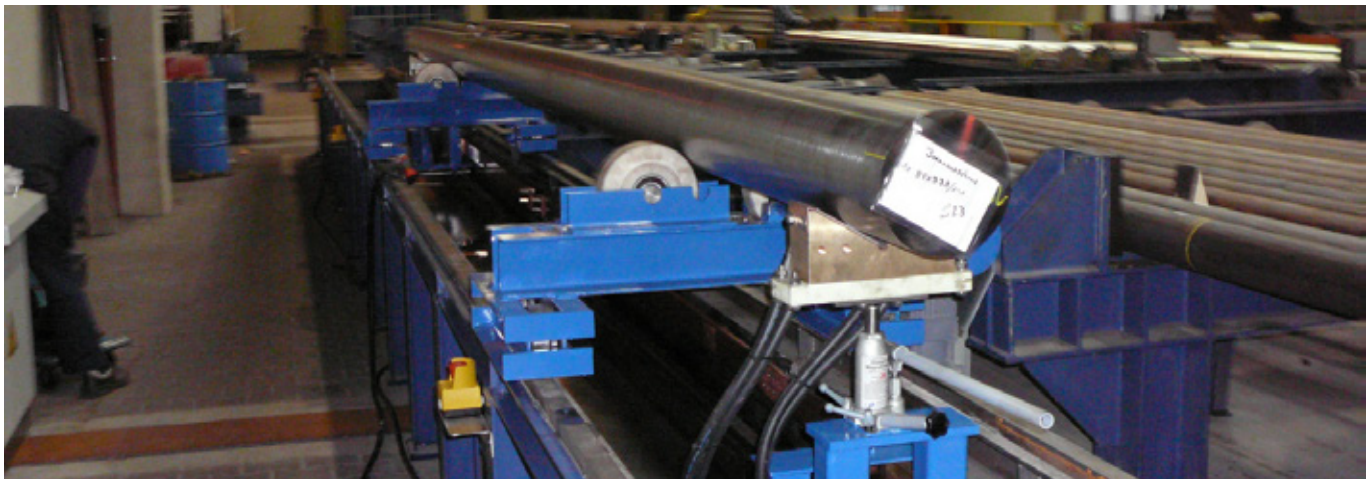
The automatic evaluation in the lower display show the recognized linear displays. Selected are those with 15mm minimum length. Each crack identified as being continuous with intermittent displays appears in a different color.

Customer specific evaluation criteria classify these objects according to size, direction, location, density of faults and display intensity.

The software visualizes each identified crack according to a pre adjusted minimum length. Artifacts are sorted out as well as clamps etc.

In the production line the inspection system must be ruggedized with respect to vibrations dust, fluctuations of the luminosity and magnetizability of the test powder.

EFFICIENT MAGNETIZATION

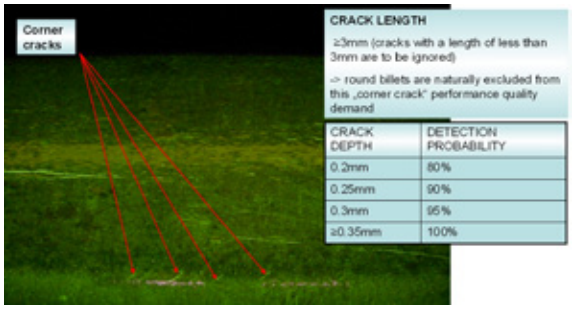


Magnetization by current flow is the most effective way for long objects. It is optimal for cracks along the way of current flow at the surface + 45°.

With testing currents up to 5000A we achieve the necessary flux density even for big test objects of 15m length and 300mm diameter.

The picture above shows a test shaft of this dimension. For orthogonal cracks we offer an additional field flow magnetization with an open yoke construction.

DETECTION RELIABILITY



The experimental results for short corner cracks are shown in this picture.

Even short cracks above 3mm length are detected with remarkable probability by current flow magnetization, even if they are not in longitudinal direction.

AUTOMATIC CRACK REMOVAL

We transmit the coordinates of the crack to a grinding robot. The affected areas will be grinded automatically with a specified depth.

Afterword the billet is inserted again in the inspection system to see whether the cracks are removed totally. The system remembers the accumulated grinding steps per crack, so that it stops at a predefined depth. The visualization software allows to display a selected crack after each grinding step.

INTEGRATION INTO EXISTING PRODUCTION LINE

Pattern recognition is ideally suited for integration in a fully automated test equipment.

We are your partner for planning, develop and build your system to exactly meet your requirements.
We supply complete inspection systems with state-of-the-art technology .

By connecting the system to an in-house product data base each test item will be evaluated according to individual test criteria. With the stored results a back tracing and statistical evaluations are possible.

Features

- High and reproducible recognition rate, few pseudo images
- Complete documentation of test results including images
- Inspection of billets directly on the roller-way
- High magnetization level
- Simple adaption of test programs to customer specific criteria
- Constant monitoring of all system components
- Industry proven and able to be integrated into existing production lines

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