

OPTICAL SURFACE INSPECTION IN ROLL GRINDERS

RSIS Optical Roll Surface Inspection System



FEATURES

- Optical Surface Scanner for Ground Rolls
- Installation in Roll Grinder Machines etc.
- Detection and Classification of Surface Textures & Single Defects
Chatter, Feed Lines, Spirals, Shadows, Twists, Diagonals, Grit Marks, Comma etc.
- Advanced Chatter Analysis
- Compact and Rugged Sensor Head with Integrated Laser Source
- 2D Surface Visualisation, Thresholding, Go/No-Go Gauging
- Data Archive, Shift reports, Offline Data Visualisation

RSIS - Objectives

The surface quality of flat rolled products is given top priority in many applications (steel, aluminium, copper/brass etc.).

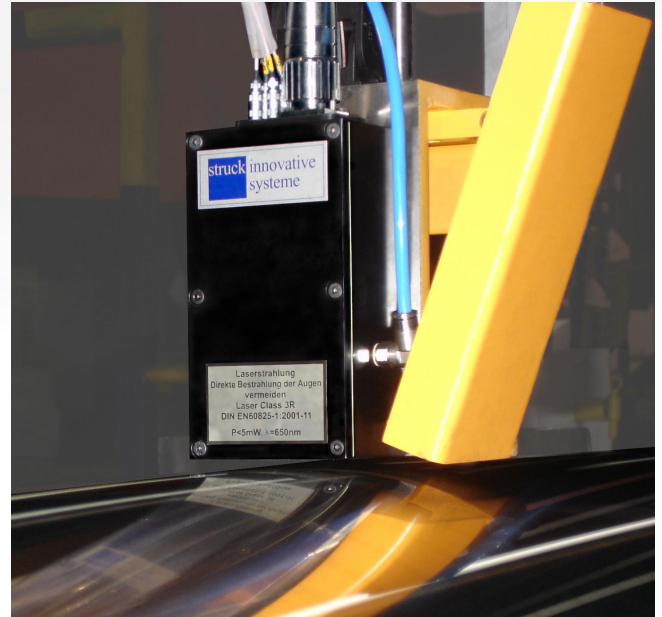
Strip surface textures, as a matter of course, are typically originated by the characteristics of the work rolls. Any surface pattern or anomaly on a work roll is repetitively “rolled” into the metals.

Even for the roll shop machine operator with an "expert eye" it is hardly possible to pinpoint faint surface textures (chatter, spirals etc.) on ground rolls over an entire production shift on a constantly high reliability level.

Furthermore today's roll grinders are more and more operated in automated roll shops with limited time left for visual inspection.

As a result:

From time to time imperfect work rolls leave the roll shop, thus wasting costly production time when used in the mill. In this case the benefits of an automated optical scanner are even more evident.

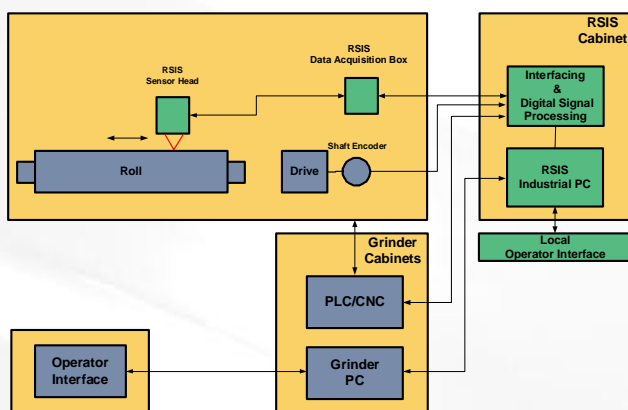


RSIS Sensor during Surface Inspection Scan

RSIS - System

The RSIS system includes the following main elements:

- Smart Opto-Electronic Sensor/Laser Head.
- Data Acquisition Box (Mounted at machine)
- Electrical Cabinet (optional), Industrial PC
- Linear Actuator to Position Sensor above Roll Surface
- Interface with Roll Grinder (PLC, Communication)



RSIS Principle System Arrangement

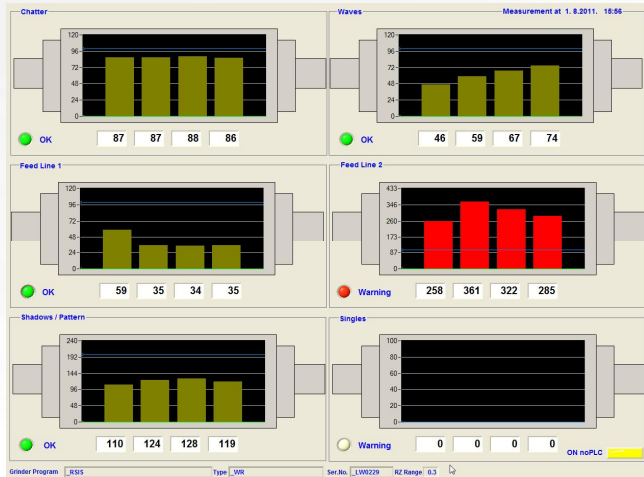
RSIS – Technical Data

- Continuous Laser Light <1mW (Class 2M)
- Multiple Photo Sensor Arrangement
- Pixel size Z-Direction 50µm
- 14Bit, 40Mhz Fast Multi Channel Digitizer
- Fiber Optical Data Transmission to Cabinet
- 100% Surface Scan
- Distance to Roll Surface 4mm
- Feed/Rev (Z-Direction) typ. 5mm
- Max. Roll Surface Speed <90m/min (typ.)
- Inspection Time ca. 8min for a 500mm x 2000mm Roll
- Inspection Scan Cycle after Finishing Pass
- Typ. Roughness Range: 0.05 < Ra < 2.5
- Defect Classification & Analysis
Chatter, Spirals (Feed Marks), Pattern, Diagonals
Single Defects, Grit Marks (Comma), Indents, Pits etc.
- Data Volume per Roll (e.g. 500 x 2000mm) ca. 1GByte
- Sensor Size ca. 170x85x60mm, ca. 1.5kg
- Controller Box ca. 300x400x210mm, ca. 10kg
- Environm. Temperature <45°C
- Air supply
 - Continuous Rinsing Air (Instrument Air) <0.7bar
 - Air Knife (where required) < 6bar
- RSIS requires a clean Surface for optimal Results

RSIS - Results

RSIS presents results in different ways. The operators basic screen provides clearly arranged summary information of the surface rating.

The roll surface is partitioned into four Z-axis sections. The rating results are represented as vertical bars for each section. If a bar exceeds the dedicated intensity threshold it is highlighted by red color. The screen provides individual ratings for chatter, feed lines, shadows and single defects (marks, commas).



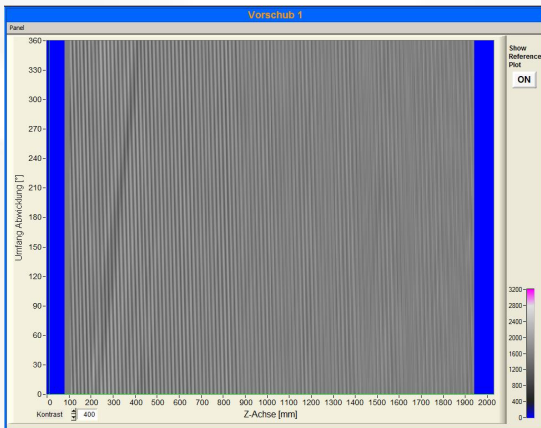
Basic Operators Screen

2D surface images can be selected by mouse click or keys to access more detailed information..

2D Image Examples from Work Rolls:

2D images represent the unwound roll surface. The horizontal axis corresponds to the roll length (Z-axis), the vertical axis corresponds to the circumference (0..360°). The grey shading and color setting correspond to the defect intensities.

Feed lines (spirals) appear as vertically oriented structures as shown below.

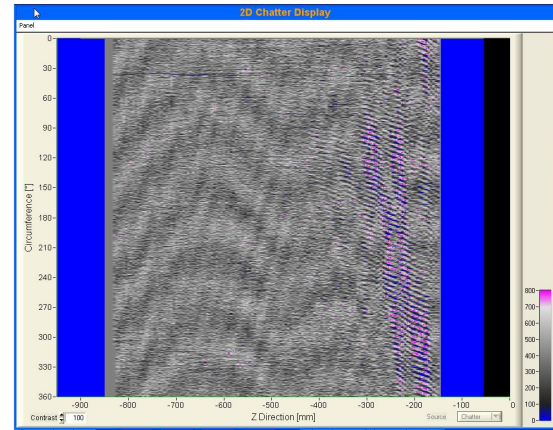


Spirals in Work Roll 500 x 2000mm Tandem CRM

Chatter marks appear as horizontally oriented short wave structures.

The screen shot below shows a non-acceptable roll surface from a Z-mill roll surface (Diameter 90mm, length 900mm). A faint chatter structure shows up in the right section of the roll.

The image is overlaid with some long wave structures on the roll surface that are non-critical for production.

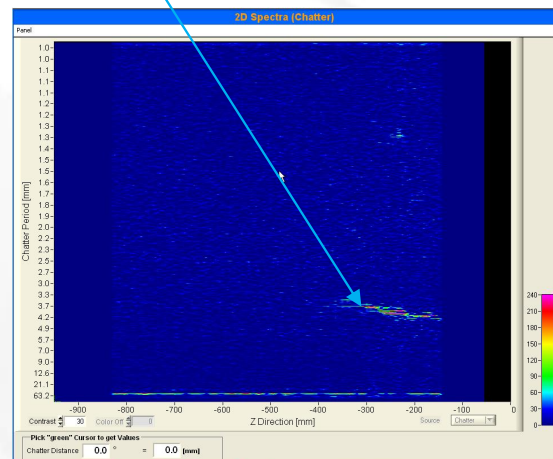


2D Image Partial Chatter Marks

Advanced chatter analysis is provided in order to classify the chatter textures by peak distances, number of peaks per revolution, chatter amplitude etc.

The screen shot below shows a colour coded 2D chatter analysis distribution along the full barrel (horizontal axis). The vertical axis corresponds to the chatter distance (bottom: long peak distance, top: short peak distance). "Hot" colours (orange, red..) correspond to more intense chatter amplitudes. The screen shot correlates to the previous image above.

Chatter with ca. 4mm chatter distance between Z-position 150mm to 300mm



Chatter Analysis Image

Single Defects

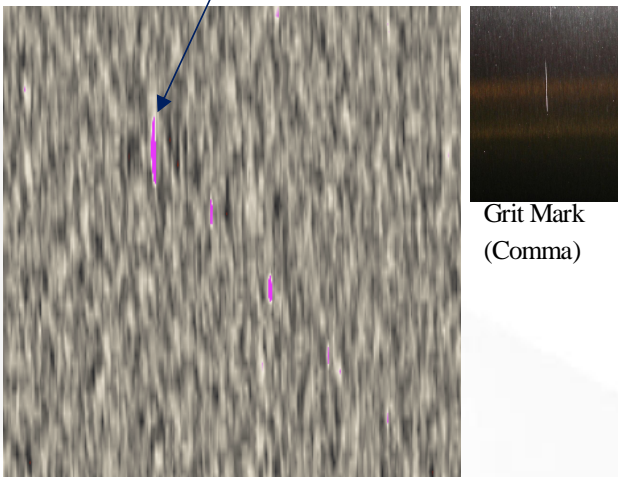
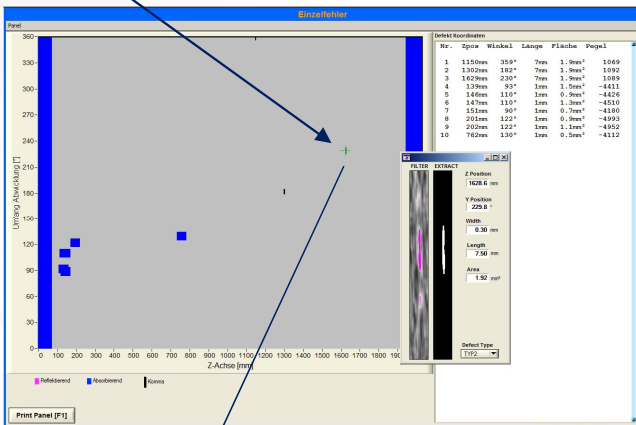
Severe single defects on a work roll like grit marks (comma) are very difficult to visually spot by an operator. Moreover, they can cause huge damage due to scrap production in the final passes of cold rolling.

RSIS checks the surface for these single (rare) defects.

Symbolic visualisation of single defects:

- Vertical black = grit marks,
- Dark blue dark squares = dark marks
- Magenta squares = reflecting marks

A mouse click to a symbol opens up the related grey scale picture:



Single 7mm Grit Mark (Comma) as filtered by RSIS

Various settings are available to classify allowed grit mark size, length, intensity etc.

The exact co-ordinate (Z-axis and angular position) of the defect allows the operator to locate the defect on the roll in order to visually judge it.

RSIS - Benefits

- Identifies finest roll surface patterns
- Scratch and mark detection / classification
- Prevents unacceptable textures on rolled products to improve mill efficiency
- Supports automated QM quality monitoring procedures
- Achieves objective roll surface quality ratings
- Supports operator
- Monitors continuously the grinder performance
- Generates roll data base (reports)
- Offline analysis of archived data records
- Upgrade of existing machine as stand alone system
- Full integration into new machines
- Grinding machine and process analysis tool

RSIS - Options

Stand Alone System

RSIS as an upgrade system to an existing roll grinding machine. Employ simple PLC communication. Inspection cycle typically invoked after finishing. Separate operator Terminal / monitor

Integrated System

RSIS is a fully integrated roll grinder operation system. Employs sophisticated PLC and data communication with the roll grinder. RSIS operated mainly via grinder terminal

Related Products

RMD Inline Roll Mark Detector

- Detects repetitive Defects on Aluminium Foil during Rolling (up to 2000m/min, Defect Size <0.2mm)

PHD Inline Pinhole Detector / Analyzer

- Detects and measures Pinholes in Aluminium Foil down to 10µm Diameter at speeds up to 1400m/min and widths up to 2100mm

