INTEL

3D Au

defects

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LIGRIND	BENEFITS
	Higher productivity
comatic surface detection and ng	Increase safety
	Reduction of human operator error
	Reduces amount of grinding operations, saving on grindstone wear and grinding time
	Steel material saving
	Constant quality control feedback to caster
	Better defects reasons identification thanks to defects database
	Fast payback period: less than 1.5 years compared to a plant with cold inspection and conditioning
	Quick return of investment

PROCESS

INTELLIGRIND provides the ultimate in 3D surface defect inspection. It is an optical system for in-line inspection of slab surface in process after grinding procedure. The acquisition system is composed of a set of high-definition cameras (HD), with lights mounted crossways to the grinding table travelling direction to scan the slab upper and lateral faces. The lower face can be acquired and scanned after slab grinding and tilt in a second passage under the acquisition system. INTELLIGRIND provides for the operator a high-definition picture and surface scan of the slab in order to highlight the presence of surface-defects for a consequent grinding. All three dimensions -X-Y-Z- are acquired in order to have a complete slab map. A special adaptive algorithm, trained to identify typical surface defects, can be applied on the slab map to identify surface areas to be ground.

The features of the system are the following: > High-Definition (HD) surface acquisition system (non-contact) of travelling slab; > Images filtering and merging in one HD map; > Display of the whole slab on a dedicated monitor No. 1 (full slab length view); > Display of a slab zoomed portion on a dedicated monitor No. 2 (zoomed view); > Image tools for zooming and selecting defects coordinates (grinding spots coordinates); > Transfer to Level 2 of grinding spots coordinates for scheduling;
 > Defects detection: 0.9 x 0.9 mm;
 > Image acquisition time: approx. 0.4 s.

EQUIPMENT

The sturdy and compact construction makes INTELLIGRIND suitable for installation in the steelmaking environment, accounting for pollution, dust and vibrations. The acquisition system is an image acquisition unit that is mounted at the exit side of the grinding machine. It records a high-definition image (HD) of the slab travelling on the grinding table as it passes the image acquisition system array. The array

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1 Display of the whole slab on a dedicated nonitor No. 1 (full slab length view). 2 Display of a slab zoomed portion on a dedicated monitor No. 2 (zoomed view). 3 Arrangement of the High-Definition (HD) surface acquisition system (non-contact) of travelling slab. 4 Danieli Automation HiNSPECT system HMI. 5 HiNSPECT system components during Factory Acceptance Test at Danieli Automation laboratories

is made with special lights and cameras, designed for steel plant environment, useful at different slab temperatures for an optimized image reconstruction. A rack with PCs for the acquisition and processing, including the gigabit Ethernet switch for data acquisition, is located in the pulpit or another separate room. The processors are in charge of collecting the images frames and surface profile from each camera in order to generate a series of final mosaic-slab-transversal-slice images to be served to the supervisory operator's monitors. The system consists of the following equipment:

> Video cameras and lights array: a set of high-definition cameras and special lights mounted crossways to the slabs transporting area;

 > Cleaning system: the air compressed camera lenses and lights protection window cleaning system;

> Cooling system: closed water circuit;
> Electrical switchboard;

 > Ethernet switches, which collect signals from cameras and have an exit signal in optic fiber (Giga-Ethernet) to the computer rack;
 > Rack, a 19" type board with a PC for images and surface acquisition and processing.







PERFORMANCE ACHIEVEMENTS

The shape of the object is deduced from the way light is reflected, assuming a known illumination. This is the principle of the Depth Detection Surveyor (DDS). INTELLIGRIND uses the "shape from shading" technique, where the shape of the surface is reconstructed from the difference in shading, in order to obtain a 3D image of the slab surface and revealing the depth of the defect.

Each image acquired by the HD Video Cameras as the surface scanners are conveyed through optical fiber to PCs Rack in charge to acquire, filter, synchronize and elaborate the information.

A range of defect libraries with automatic defect recognition provides the operator with a powerful tool for automatic detection and position location. The position coordinates are stored and fed to the INTELLIGRIND system to enable automatic grinding of the slab surface to the correct depth.