Atline Inspection of Casting Production Process at Volkswagen using VG Inline
Atline Inspection of Casting Production Process at Volkswagen using VG Inline

Authors: Dr.-Ing. Raimund Rösch, Frank Jeltsch
Dr.-Ing. Ferdinand Hansen, Michael Kurtz,
(Volkswagen Foundry Hanover),

Dr. Sven Gondrom, Thomas Günther
(Volume Graphics GmbH),

ECNDT October, 06.-10., 2014, Prague
Content

1. The new fast CT System
2. Using VG InLine
3. Inspection scenario
4. Process optimizations based on statistics
5. Feature request
1. Motivation for fast CT

Reduce the scan time to achieve statistic based part inspection

Scan time for one part

400 min

< 3 min

Typical fanbeam CT

fast CT

Dr.-Ing. R. Rösch, Dr. F. Hansen, F. Jeltsch, M. Kurtz, (alle Volkswagen Gießerei Hannover), Dr. Sven Gondrom, Thomas Günther (Volume Graphics GmbH)
1. The new fast CT System
Speed\scan atlineCT - GE Sensing & Inspection Technologies

Manufacturer: GE Sensing & Inspection Technologies
Type: Gantry CT, based on modified GE Healthcare technology
Source: 140 kV (53 kW) dual spot, rotating anode tube
Detector: 16 lines, 912 channels
Measurement volume: approx. 300 x 400 x 800 mm
Voxel resolution: approx. 0.5 x 0.5 x 0.5 mm (typical cylinder head)
1. The new fast CT System

Location near production on shop floor area

Dr.-Ing. R. Rösch, Dr. F. Hansen, F. Jeltsch, M. Kurtz, (alle Volkswagen Gießerei Hannover), Dr. Sven Gondrom, Thomas Günther (Volume Graphics GmbH)
1. Requirements for fast AtLineCT

Features:

• rapid testing and automatic results on main deviations
• shorter period to production readiness for new parts
• quicker process optimization, based on statistics
• reduced reject rate in series
1. History of Speed\textregistered scan AtLineCT at Volkswagen

Inspection history of AtLineCT at Volkswagen:

- installation of AtlineCT system \hspace{1cm} May 2013
- start of inspections \hspace{1cm} June 2013
- number of inspections 2013 \hspace{1cm} 6,700
- number of inspections 2014 until September \hspace{1cm} 13,500
2. Using VG InLine

Inspection scenarios with AtLineCT at Volkswagen

Pores and shrinkages

Remainder from sand core
2. Using VG InLine

Inspection scenarios with AtLineCT at Volkswagen

Wall thickness

normal penetration length

through Aluminum

Nominal/actual comparison
2. Using VG InLine
The VG Inline Controller

Work Schedule for VG Inline

Step 1: Load application settings (04LE_14.2_14.vgsettings)
Step 2: Open input file
Step 3: Play macro Erweiterte Oberflächenbestimmung Fester Wert.vgc
Step 4: Play macro Einladen CAD ROH.vgc
   Input (job): CAD_ROH.stl
Step 5: Play macro Einladen CAD-Fertig.vgc
   Input (job): CAD_Fertig.stl
Step 6: Play macro Einladen CAD-EB.vgc
   Input (job): CAD_EB.stl
Step 7: Play macro Einladen CAD WJO.vgc
   Input (job): CAD_WJO.stl
Step 8: Play macro Einladen CAD WJU.vgc
   Input (job): CAD_WJU.stl
Step 9: Play macro Einladen CAD DK.vgc
   Input (job): CAD_DK.stl
Step 10: Play macro Polygon 3 und 6 löschen.vgc
Step 11: Play macro Bestfit auf ROH-CAD.vgc
Step 12: Play macro RPS Ausrichtung mit Messplan.vgc
   Input (job): 04L_103_373_Ausrichtung.vgt
Step 13: Play macro alles.vgc
   Output: [project_name].WD Oberer Bereich html
   Output: [project_name].Bilder DK-Lage.html
   Output: [project_name].Sand Oberer WR.html
   Output: [project_name].Sand Unterer WR.html
   Output: [project_name].Foren global ab 3cm.html
   Input (job): WD 4.0.4 ROH Oberer Bereich 1.7.vgc
   Input (job): Soll_ist_DK Bilder.vgc
   Input (job): 4LE Sand WR WD 4.0.4 Bereich 1.7 Pore ab 3.vgc
Step 14: Retrieve evaluation state
Step 15: Save file
   Output: [project_name].ausg.vgl
3. Inspection scenario

Process optimization for a new tilt casting method:
1. Scanning the first poured parts
2. Automatically evaluation of main features, as pores and shrinkages, wall thickness, characteristics of the sand core and sand back-filling.
4. Process optimization based on statistics

Analysis optimization step one - deformation of water jacket 2,6 mm

VG Inline, automatically generated result

VGStudio Max, part with CAD-Model outline,
4. Process optimization based on statistics

Analysis optimization step two - deformation of water jacket 1,0 mm

VG Inline, Automatically generated result

VGStudio Max, part with CAD-Model outline,
4. Process optimization based on statistics

Analysis optimization step three – no deformation of water jacket

VG Inline, automatically generated result

VGStudio Max, part with CAD-Model outline,
4. Process optimization based on statistics

Analysis optimization step three – no deformation of water jacket, but pores as result of correcting parameters against deformation

VG Inline, automatically generated result

VGStudio Max, part with pore clipped,
4. Process optimization based on statistics

End of optimization – no deformation and no pores

VGStudio Max, part clipped,
4. Process optimization based on statistics

Remaining sand core in water-jacket after back-filling

VG Inline, automatically generated result
4. Process optimization based on statistics

Remaining sand core in water-jacket after back-filling

VG Inline, automatically generated result
4. Process optimization based on statistics
Successful change of parameters – no remaining pieces of sand core

VGStudio Max, part clipped,
6. Feature request / Outlook

• More options for record documentation
  • Show CAD-Model
  • Save pictures at various positions
  • Various design of records
  • Format options for records
  • Usage of variables (information from part properties)

• Data bank management for part information and easy backups

• More feedback information for macro/job process
  • Errors, fail/pass (best-fit)
  • Job processing step by step

• Optimized correction of beam hardening